



NAVAL
POSTGRADUATE
SCHOOL

MONTEREY CALIFORNIA

THESIS

**WEB PORTAL DESIGN, EXECUTION AND
SUSTAINABILITY FOR NAVAL WEBSITES
AND WEB SERVICES**

by

Saundra L. Amsden

December 2003

Thesis Advisor:
Thesis Co-Advisor
Second Reader:

Don Brutzman
Curt Blais
Barb Helfer

Approved for public release; distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE December 2003	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE: Portal Design , Execution and Sustainability for Naval Websites and Web Services			5. FUNDING NUMBERS	
6. AUTHOR Saundra L. Amsden				
7. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE A	
13. ABSTRACT <p>With the rapid evolution of Web-based technologies, keeping up with the latest trends is a complicated process. The newest "Web Service" is the development of Web Portals. Portals allow the design of Web Services in such a way as to allow the users to define their needs, and create a home of their own within a site. As users become more proficient, knowledgeable and demanding, this technology will expand due to the demand of users.</p> <p>As with all new technology, it includes significant benefits and pitfalls. Determining where to best use Web Services and Portals is important. The plethora of tools being promoted for the development of portals is significant, and choosing the right tool to accomplish the task while ensuring compatibility is critical. Already, considerable work has been accomplished by Task Force Web and the Fleet Numerical Meteorology and Oceanography Center. An important factor in the decision process is in meeting the demands of an ever increasing technology literate environment. Reaching the goal of a fully connected Navy will require significant expenditure of money and manpower, but will reap large benefits from the long-term value of improved training and access to knowledge.</p> <p>This research looks at Web Services and Web Portals, examining the design of portals and an evaluation of their use.</p>				
14. SUBJECT TERMS Web Services, Web Portals, NEP, Navy Enterprise Portal, TF Web, Task Force Web, Knowledge Management			15. NUMBER OF PAGES 121	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

**WEB PORTAL DESIGN, EXECUTION AND SUSTAINABILITY FOR
NAVAL WEBSITES AND WEB SERVICES**

Saundra L. Amsden
Lieutenant Commander, United States Navy
B.S., University of Montana, 1988

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN COMPUTER SCIENCE

from the

**NAVAL POSTGRADUATE SCHOOL
December 2003**

Author: Saundra L. Amsden

Approved by: Don Brutzman
Thesis Advisor

Curt Blais
Co-Advisor

Barb Helfer
Second Reader

Peter Denning
Chair, Department of Computer Science

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

With the rapid evolution of Web-based technologies, keeping up with the latest trends is a complicated process. The newest “Web Service” is the development of Web Portals. Portals allow the design of Web Services in such a way as to allow the users to define their needs, and create a home of their own within a site. As users become more proficient, knowledgeable and demanding, this technology will expand due to the demand of users.

As with all new technology, it includes significant benefits and pitfalls. Determining where to best use Web Services and Portals is important. The plethora of tools being promoted for the development of portals is significant, and choosing the right tool to accomplish the task while ensuring compatibility is critical. Already, considerable work has been accomplished by Task Force Web and the Fleet Numerical Meteorology and Oceanography Center. An important factor in the decision process is in meeting the demands of an ever increasing technology literate environment. Reaching the goal of a fully connected Navy will require significant expenditure of money and manpower, but will reap large benefits from the long-term value of improved training and access to knowledge.

This research looks at Web Services and Web Portals, examining the design of portals and an evaluation of their use.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	OVERVIEW.....	1
B.	MOTIVATION	1
C.	OBJECTIVES	2
D.	THESIS ORGANIZATION.....	2
II.	RELATED WORK.....	5
A.	INTRODUCTION.....	5
B.	WEBSITE DESIGN.....	5
1.	Pitfalls In Website Design	5
2.	Good Website Design Guidelines.....	6
3.	User Accessibility	7
C.	SIGGRAPH ONLINE	11
1.	ACM SIGGRAPH.....	11
D.	SHARABLE CONTENT OBJECT REFERENCE MODEL (SCORM) AND ADVANCED DISTRUBUTED LEARNING (ADL).....	14
1.	Advanced Distributed Learning (ADL).....	14
2.	Sharable Content Object Reference Model (SCORM)	14
a.	<i>SCORM Content Aggregation Model.....</i>	<i>15</i>
b.	<i>SCORM Run-Time Environment.....</i>	<i>16</i>
c.	<i>SCORM Process.....</i>	<i>16</i>
E.	MAILING LISTS AND HYPERMAIL ARCHIVES	17
F.	WEB LOGGING (BLOGGING).....	19
G.	DYNAMIC HYPERTEXT MARKUP LANGUAGE (DHTML)	20
H.	KEY STANDARDS	23
1.	Extensible Markup Language (XML).....	23
2.	Extensible HTML (XHTML).....	24
3.	Extensible Stylesheet Language Transformations (XSLT).....	25
4.	Portable Network Graphics (PNG)	27
I.	SUMMARY	27
III.	WEB PORTALS AND WEB SERVICES	29
A.	INTRODUCTION.....	29
B.	WEB SERVICES DEFINED	29
1.	Evolution Of Web Services	31
a.	<i>Two-tier Model.....</i>	<i>31</i>
b.	<i>Web-based Application Model.....</i>	<i>31</i>
c.	<i>Web Services Model</i>	<i>32</i>
2.	Key Related XML-Based Technologies	33
C.	WEB PORTALS DEFINED	33
D.	EXTENSIBLE MODELING AND SIMULATION FRAMEWORK (XMSF).....	36
E.	SUMMARY	37

IV.	OPEN SOURCE PORTAL SOFTWARE	39
A.	INTRODUCTION.....	39
B.	APACHE JETSPEED	39
C.	PLONE.....	41
D.	UPortal.....	44
G.	SUMMARY	47
V.	NAVAL WEB PORTAL DEVELOPMENT	49
A.	INTRODUCTION.....	49
B.	TASK FORCE WEB (TF WEB)	49
1.	Navy Enterprise Portal (NEP)	49
2.	Single Sign-on (SSO).....	52
3.	Universal E-Mail	52
D.	NAVY KNOWLEDGE ONLINE (NKO)	52
E.	FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER (FNMOC)	56
F.	SUMMARY	58
VI.	CASE STUDIES.....	59
A.	INTRODUCTION.....	59
B.	FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER (FNMOC) PORTAL ASSESSMENT	60
1.	Access and Security.....	60
a.	Gateway.	60
b.	Security.....	60
2.	Information.....	60
a.	Customized information.....	60
b.	Channel information.	60
c.	Pushed information.	61
3.	Functionality.....	61
a.	Personalization.....	61
b.	Internet tools.	61
c.	Personalized tools.....	61
4.	Communications	61
a.	Interaction.	61
b.	Schedule meetings.....	61
c.	Electronic balloting.....	61
5.	Integration	61
a.	Workflow and application integration.	61
C.	DUDLEY KNOX LIBRARY PORTAL.....	68
1.	Access and Security.....	68
a.	Gateway.	68
b.	Security.....	68
2.	Information.....	68
a.	Customized information.....	68
b.	Channel information.	68
c.	Pushed information.	68

3.	Functionality.....	69
a.	Personalization.....	69
b.	Internet tools.	69
c.	Personalized tools.....	69
4.	Communications	69
a.	Interaction.	69
b.	Schedule meetings.....	69
c.	Electronic balloting.....	69
5.	Integration	69
a.	Workflow and application integration.	69
D.	UNDERSEA WARFARE (USW) WEBSITE AND PORTAL DESIGN..	77
1.	Access and Security.....	78
a.	Gateway.	78
b.	Security.....	78
2.	Information.....	78
a.	Customized information.....	78
b.	Channel information.	78
c.	Pushed information.	78
3.	Functionality.....	78
a.	Personalization.....	78
b.	Internet tools.	78
c.	Personalized tools.....	78
4.	Communications	78
a.	Interaction.	78
b.	Schedule meetings.....	78
c.	Electronic balloting.....	79
5.	Integration	79
a.	Workflow and application integration.	79
E.	SUMMARY	82
VII.	CONCLUSIONS AND RECOMMENDATIONS.....	85
A.	CONCLUSIONS	85
1.	Portal Development	85
2.	Portal Keys	85
3.	Portal Wisdom.....	85
B.	RECOMMENDATIONS FOR FUTURE WORK.....	86
1.	Single Sign-on (SSO).....	86
2.	Navy Portal Development Strategies.....	87
a.	Importance of Shared Strategies.....	87
b.	Separate Development Technology	88
c.	Roles and Responsibilities	89
	APPENDIX A. LIST OF ABBREVIATIONS.....	91
	LIST OF REFERENCES.....	95
	INITIAL DISTRIBUTION LIST	101

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

Figure 1.	Text pop-up example. When the cursor is hovering over a specific area, a box with detailed information pops up (From [Nielsen-99]).....	7
Figure 2.	NPS Website evaluated by Bobby tm with linked recommendation icons superimposed (From [Bobby-03]).....	9
Figure 3.	Linked recommendations for detailed evaluation of the NPS Website by Bobby tm (From [Bobby-03]).....	10
Figure 4.	Detailed description of an accessibility error and recommendations on how to implement a fix. (From [Bobby-03]).....	11
Figure 5.	ACM SIGGRAPH portal powered by Plone (From [Plone]).....	12
Figure 6.	French version of the Montreal chapter of SIGGRAPH home page [ACM Montreal]	13
Figure 7.	English version of the Montreal chapter of SIGGRAPH home page [ACM Montreal]	13
Figure 8.	Illustration of the SCORM (From [SCORM-02]).....	15
Figure 9.	Process of delivering a course (From [SCORM-02])	17
Figure 10.	Hypermail web page example (From [Lists-00])	18
Figure 11.	DHTML Demo (From: [SolAdv])	22
Figure 12.	DHTML Demo – User designed (From: [SolAdv])	22
Figure 13.	Simple HTML document (From: [Giguere])	24
Figure 14.	The HTML document transformed into a simple XHTML document (From [Giguere]).....	25
Figure 15.	Basic XSLT process model where a Stylesheet is applied to a source document.....	26
Figure 16.	Structural overview of an XSLT stylesheet (From: [XSLT-03])	26
Figure 17.	Function of a Web Service, showing the relationship between the three functional areas.	30
Figure 18.	Two-Tier model. The client-server is directly connected to the database.	31
Figure 19.	Web-based model. The client is connected to a web server, which then accesses the application server.....	32
Figure 20.	Web Services model. The client and the database are connected through layered Web Services.....	32
Figure 21.	Basic Portal design. Multiple tabs (or pages) each contain multiple channels/portlets.	34
Figure 22.	Sample Jetspeed page. The default page as it loads when first installed.	41
Figure 23.	An example experimental Plone portal designed by SIGGRAPH (From: [SIGGRAPH-03]).....	43
Figure 24.	Sample Plone page. The Plone homepage (From [Plone]).....	44
Figure 25.	Sample uPortal design, Arizona State University portal (From [ASU])	46
Figure 26.	Entrance to the portal for the US Navy’s recruiting site. The potential recruit enters here to begin an exploration of what the Navy has to offer. (From www.navy.com).....	50

Figure 27.	Creating a Navy Locker. The interested potential recruit can create his own “Navy Locker” to discover what the Navy is about. (From www.navy.com).....	50
Figure 28.	The potential recruit’s “Navy Locker” Here he can keep track of the topics and resources of interest. (From www.navy.com)	51
Figure 29.	Navy Knowledge Online Portal access. Entrance to the world of the naval career. (From [NKO]).....	54
Figure 30.	Navy Knowledge Online home page. Stepping off point to anything a member needs for a naval career. (From [NKO])	55
Figure 31.	High level diagram of the N-tier Navy Enterprise Portal architecture (From: [Collab-03]).....	56
Figure 32.	FNMOC portal sign-on (From [FNMOC]).....	62
Figure 33.	Default home page for FNMOC portal (From [FNMOC]).....	62
Figure 34.	FNMOC portal tab, a page within the site (From [FNMOC])	63
Figure 35.	Customizing the FNMOC portal (From [FNMOC]).....	63
Figure 36.	Customizing the FNMOC portal (From [FNMOC]).....	64
Figure 37.	Color scheme change to the FNMOC portal (From [FNMOC])	64
Figure 38.	Change in pane selection style. Rather than having all the panes on one tab visible, a menu option is presented to view one pane at a time. (From [FNMOC])	65
Figure 39.	Another example of how the tabs and panes can be presented. (From [FNMOC])	65
Figure 40.	A partial list of information panes that can be added to a page. (From [FNMOC])	66
Figure 41.	Users can create their own personal page. (From [FNMOC]).....	66
Figure 42.	A user defined pane/tab containing two portlets in a two-column format. (From [FNMOC])	67
Figure 43.	FNMOC Local Weather Channel (From [FNMOC])	67
Figure 44.	Dudley Knox Library home page (From [DKL]).....	70
Figure 45.	Dudley Knox Library BOSUN search tool (From [DKL])	71
Figure 46.	Dudley Knox Library BOSUN Thesis search results on author last name “Hutton” (From [DKL])	71
Figure 47.	Dudley Knox Library BOSUN thesis search result on CAPT Claude Hutton (From [DKL]).....	72
Figure 48.	Dudley Knox Library Website search tool (From [DKL]).....	72
Figure 49.	Dudley Knox Library Database search tool (From [DKL])	73
Figure 50.	Dudley Knox Library database search tool, results of Meterology and Oceanography (From [DKL]).....	73
Figure 51.	Can’t find it? Ask the librarian directly. (From [DKL])	74
Figure 52.	Dudley Knox Library Electronic Journals available through the library (From [DKL]).....	74
Figure 53.	Dudley Knox Library Electronic Journals in Computer Science and Information Technology (From [DKL]).....	75
Figure 54.	Dudley Knox Library’s interlibrary loan request (From [DKL]).....	75
Figure 55.	Dudley Knox Library resources available on-line (From [DKL])	76

Figure 56.	Dudley Knox Library Web and search tools available (From [DKL])	76
Figure 57.	One of the categories of Web and search tools available through the Dudley Knox Library site. (From [DKL])	77
Figure 58.	Undersea Warfare (USW) home page (From [USW])	79
Figure 59.	Listing of upcoming events of relevance to the USW community (From [USW])	80
Figure 60.	Contact information (From [USW])	80
Figure 61.	Links to sites relevant to USW (From [USW])	81
Figure 62.	Links to organizations relevant to USW (From [USW]).....	81

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

Table 1.	Web Pages vs. Portals, a comparison.....	38
Table 2.	Comparison of FNMOC, NPS Dudley Knox Library and USW sites.....	83

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

Thanks to Don Brutzman, Curt Blais and Barb Helfer. You are all my saviors. Your support, patience and understanding kept me going. Thank you so much.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. OVERVIEW

Providing users of the Internet, the customers viewing the content, with customizable tools is the next generation of Web Services. The current movement is the use of Web Portals. With this change, users can enter a site and customize it to suit their needs. Portals can be personalized according to user identification. Portal pages give a web site a professional look, providing services and information to encourage users to return again and again. Users are demanding deeper access to services and information. Web portals are a single doorway through which users can easily access multiple, disparate applications, services and information sources.

Often web sites are static, providing the user with only the information that the site designers/owners think is needed. Users often find very little of a particular site to be useful, and a large volume of other related information not available directly through the site. Allowing the users to customize a site to define what is of importance to them provides a significant service by minimizing the time needed to gather data. Users are able to update the content of their portals without custom programming services.

Users also come from vastly different backgrounds. One site might have users from different parts of the world and speaking different languages. Local customs may dictate how a user would like to see the layout, language, and descriptions. Once the users have customized the site to suit their needs, they will be more likely to re-use the site in the future.

Determining what is the best tool for a developer to use would reduce the time spent testing several platforms. By doing a comparison of several Web Portal design tools, the developer can choose the tool best suited to the needs of the users and the availability of resources.

B. MOTIVATION

As the Internet expands, the difficulty users experience finding relevant information expands. Often a search results in hundreds of possible “hits,” most of which

are irrelevant to the needs or interests of the user. Web Services have made significant strides toward improving the experience of the user. The next generation of improvement is in the use of Web Portals.

Web Portals give the user a comfortable place to begin the experience of the Internet. It is like a canvas and paint, with the user creating the picture to suit his vision of the ideal Web experience.

The primary motivation is to understand what Web Services and Web Portals have to offer, how they differ, and how to best use each tool to its greatest advantage.

C. OBJECTIVES

The primary objectives of this thesis is to:

- Define Web Services and Web Portals.
- Determine the value added of a web portal.
- Analysis of two web portals currently in use.
- Analysis of candidate open source web portal engines (Jetspeed, Plone, uPortal).
- Analysis of sites that currently use Web Portals.
- Design of a Web Portal.
- Provide recommendations to facilitate the design of Web Portals on DoD and Navy web sites.

Answering these objective questions contributes to a better understanding of Web Services and Web Portals, helping designers to better develop the appropriate tool for the user.

D. THESIS ORGANIZATION

This research comprises seven chapters, summarized as follows:

- *Chapter I – Introduction:* Identifies the purpose and motivation behind conducting this research
- *Chapter II – Related Work:* Provides information on Website design, SIGGRAPH Online, SCORM, Mailing Lists and Hypermail Archives, Web Logging and DHTML and several key standards.

- *Chapter III – Web Portal and Web Services:* Introduces Web Services and Web Portals, how they differ, and the advantages of each.
- *Chapter IV – Open Source Portal Software:* Review of open source Web Portal design software
- *Chapter V – Analysis of Naval Web Portals:* A look at three organizations that are exploring the use of Web Portals.
- *Chapter VI – Case Studies:* Evaluates three “Web Portals” (Undersea Warfare (USW), Fleet Numerical Meteorology and Oceanography Center (FNMOC) and Dudley Knox Library) based upon criteria defined in Chapter III.
- *Chapter VII – Conclusions and Recommendations:* Explains the conclusions and provides recommendations regarding possible future work.

THIS PAGE INTENTIONALLY LEFT BLANK

II. RELATED WORK

A. INTRODUCTION

This chapter provides an overview of Website design, SIGGRAPH Online, Sharable Content Object Reference Model (SCORM), Mailing Lists and Hypermail Archives, Web Logging (Blogging) and Dynamic Hypertext Markup Language (DHTML).

B. WEBSITE DESIGN

Designing a website is not just a simple task of sitting down and putting a few things on a page. Two critical issues that need to be kept in mind are the intended goal of the site and who the audience will be. Looking at sites that are well designed and easy to use will help to determine what features to possibly incorporate. Looking at poorly designed sites will help in avoiding the pretty, but less than desirable, features.

1. Pitfalls In Website Design

Website designers may have a tendency to create a site from an artistic perspective. Often these attempts to beautify the site result in reduced usability. Some common mistakes that should be avoided: [Nielsen-96]

- Breaking up a page into frames can cause confusion. Navigation can be difficult. The bookmark created may not get the same view when they later try to revisit the site. Not all browsers support frames. Many users still rely on old browser versions that may not support frames. Printing can be complicated.
- The average user is more interested in content and ease of use. Using the latest technology tends to turn off the audience. It can even crash the visitor's system, discouraging repeat visits.
- Avoid the use of animation in text, marquees and objects. Movement is distracting to the user. This is becoming a bigger problem.
- A Uniform Resource Locator (URL) should be human-readable, with logical structure. Minimize typos with short, obvious names and avoid the special character sets.
- All pages should have a clear identification of what website they belong to. Always include a home page link.

- Most users will only look at the first page of a site. If it is important, be sure to have the information at the top of the page to let the user know what content is available. Provide links to jump directly to expanded context that is deeper in the page.
- Never assume the user is knowledgeable. Make finding information as easy as possible, with consistency being a key factor.
- Stick to the standard colors that users expect to see. Links are conventionally blue, and are therefore easily recognized. Don't use colors that have pre-defined meaning to the user for other purposes. The standard is black print on a white background, and is easier to read. Avoid changing the font for the majority of the text. Save that for emphasis. Consider providing the user a way to change the font size. Some users are older or may be visually impaired.
- Keep the site up-to-date. Currency of information is critical to the user.
- Users are impatient. Many users are still on dial-up modems. Offer an alternative to the 500 page PDF file.
- Never break the "back" button. This is one of the most heavily used navigation features. Opening new windows and redirecting to an undesired location annoys users.

2. Good Website Design Guidelines

Good design encourages users to repeat visits to the site. Designing a site with the user in mind, rather than the ego or artistic talents of the designer, is important. A good rule to follow is to follow the leaders. Users are familiar and comfortable with sites such as Amazon.com and Yahoo! Imitation of success leads to success. Some common sense, but often ignored, ideas to consider when designing a Website: **[Nielsen-99]**

- Include a link to the home page and place the name of the site and logo at the top of every page. Possibly make the logo a link.
- Provide a search tool if the site is large.
- Use headlines and titles that are easily understood.
- Group information to assist the user in scanning.
- Start with minimal information and provide links to pages that expand on the information.
- Use photos and images that contribute to the content.
- Use text pop-up to describe a link. (See Figure 1)

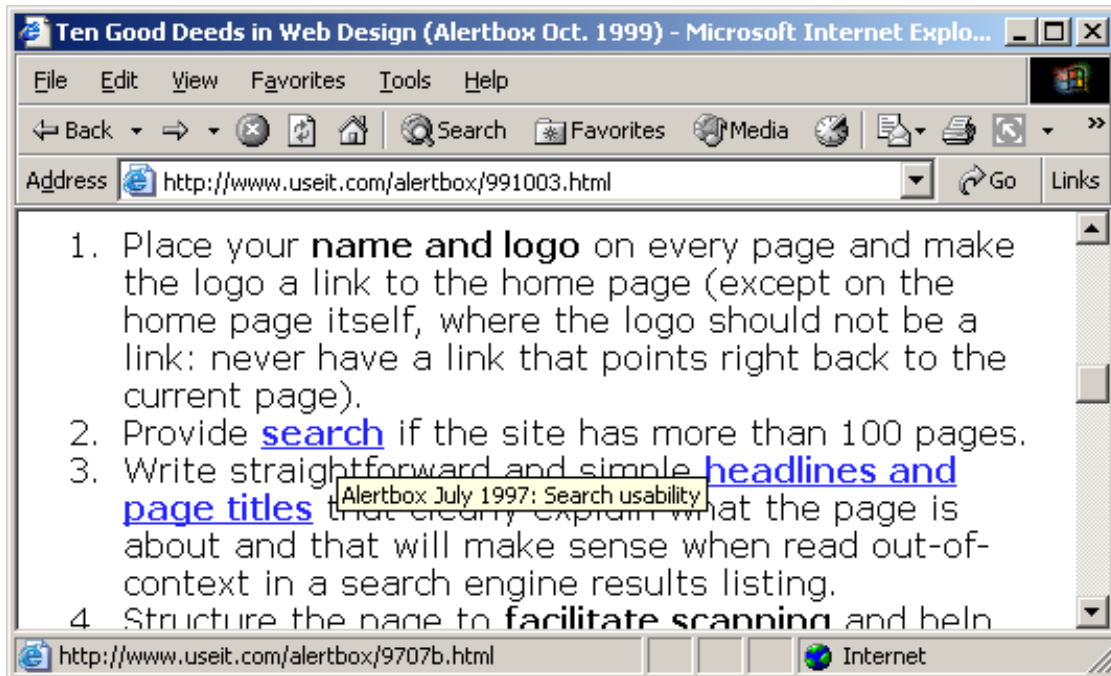


Figure 1. Text pop-up example. When the cursor is hovering over a specific area, a box with detailed information pops up (From [Nielsen-99])

- Follow common formats. Users are more comfortable with what they are familiar with.
- Test, test, test. Use real users, not professional designers, to test the site.

3. User Accessibility

The World Wide Web Consortium (W3C) is committed to leading the Web to its full potential, including advancing usability for people with disabilities. The Web Accessibility Initiative (WAI) works with organizations throughout the world, pursuing accessibility of the Web through technology, guidelines, tools, education and outreach, and research and development. W3C Director Tim Berners-Lee states “The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.” [WAI]

Web accessibility means access to the Web by everyone. Accessibility involves:

- Websites and applications that people with disabilities can perceive, understand, navigate and interact with.
- Web browsers and media players that can be used effectively by people with disabilities and that work well with assistive technologies used by people with disabilities to access the Web.

- Web authoring tools and evolving Web technologies that support production of accessible Web content.

The use of the Internet and the Web is rapidly spreading. Included in the use are millions of people with disabilities that affect their ability to access the Web. Designing a Website around disabilities can have carry-over benefits for other users. Different disabilities present their own unique barriers: **[W3C]**

- Visual – unlabeled graphics and video, poorly marked tables or frames.
- Hearing – lack of captioning for audio, text without graphics.
- Physical – single support point for commands, lack of voice portals.
- Cognitive/Neurological – inconsistent navigation structure, complex presentation, lack of non-text materials, flickering designs.

To ensure a site is accessible to the widest audience, tools are available to evaluate the site. Figure 2 through Figure 4 show an evaluation of the Naval Postgraduate School's (NPS) website by Bobby[™]. **[Bobby-03]**

The site is evaluated and a list of detected accessibility problems are generated that fall within one of three priority categories:

- Priority 1 – basic requirement for access, one or more group of users will find it impossible to use.
- Priority 2 – significantly improve access, one or more group of users will find it difficult to use.
- Priority 3 – improve access, make it easier for one or more group to use.

Bobby[™] is an on-line web accessibility tool designed to help identify and repair barriers to accessibility and encourage compliance with existing accessibility guidelines. Bobby[™] tests for compliance with government standards and offers prioritized suggestions based on the Web Content Accessibility Guidelines provided by W3C WAI. Bobby[™] tests web pages and generates summary reports highlighting critical accessibility issues. Bobby tests web pages using the guidelines established by the W3C WAI, as well as Section 508 guidelines from the Architectural and Transportation Barriers Compliance Board of the U.S. Federal Government.

Figure 2 shows the top of the report with the visual page marked up with accessibility markings. A hat with a wheelchair indicates Priority 1 accessibility errors

that were detected. The question mark (?) identifies possible Priority 1 errors that could not be fully checked, requiring the designer to address the issue manually. Figure 3 is a detailed report of the evaluated page with line numbers and a link to suggestions on how to fix the detected accessibility errors.

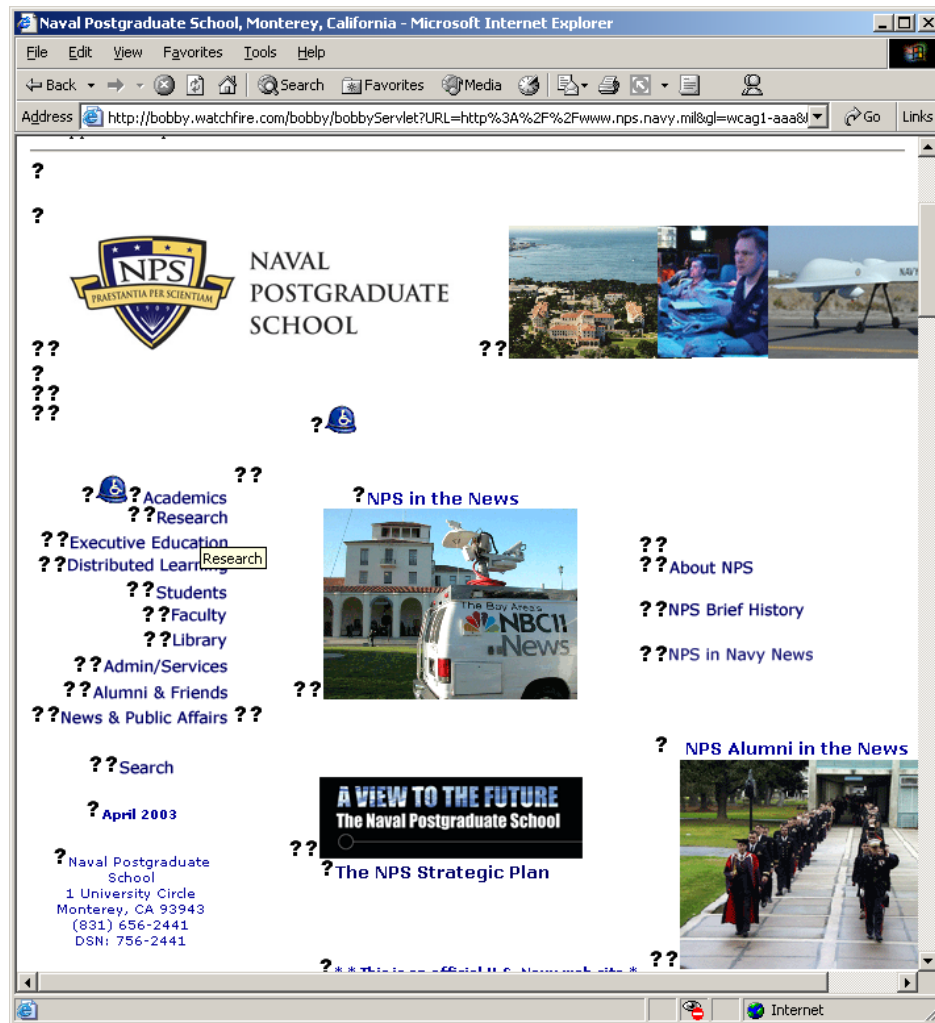


Figure 2. NPS Website evaluated by Bobbytm with linked recommendation icons superimposed (From [Bobby-03])

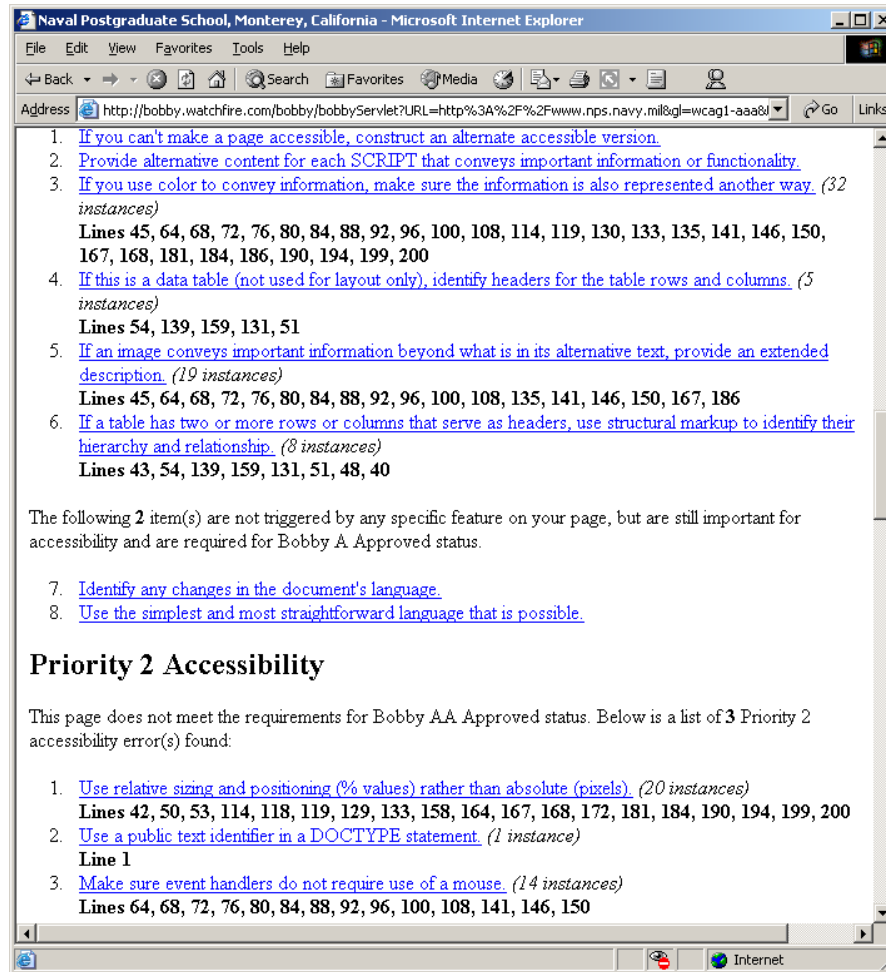


Figure 3. Linked recommendations for detailed evaluation of the NPS Website by Bobbytm
(From [Bobby-03])

In addition to ensuring the widest audience possible, designing a website friendly to users with disabilities may be a requirement. State and local governments may have guidelines in place requiring certain sites to be disability friendly. Many nongovernmental organizations also require more accessible sites.

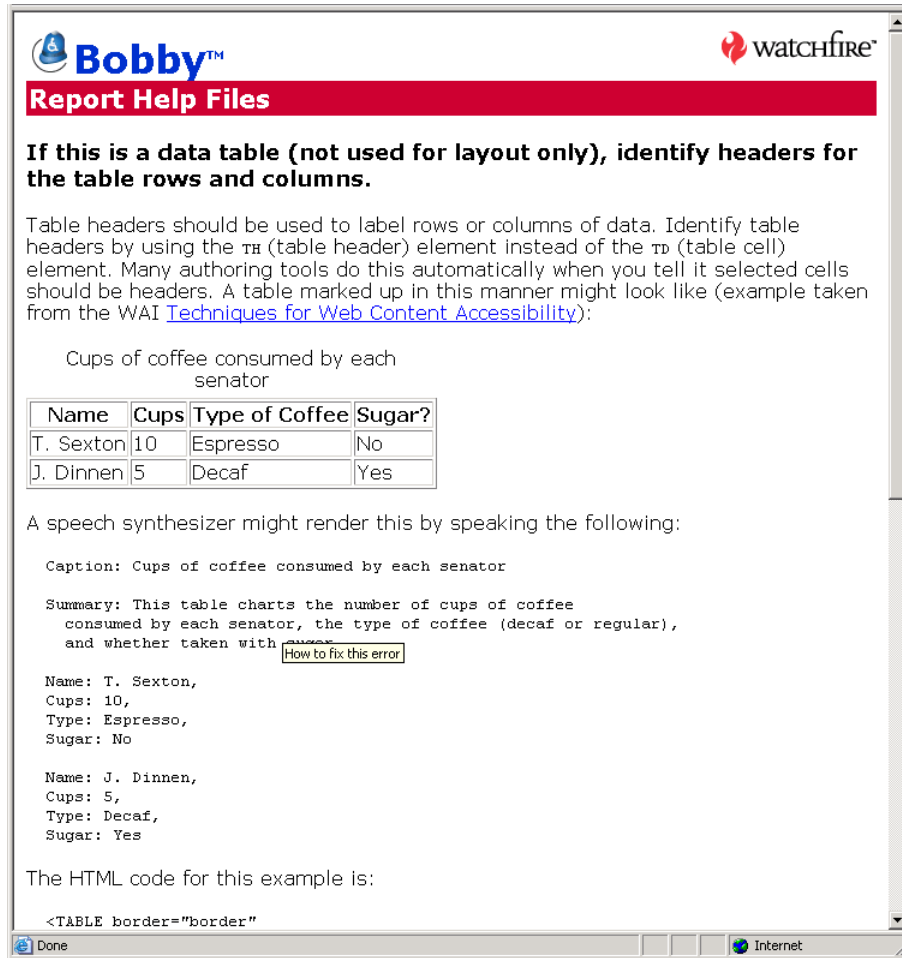


Figure 4. Detailed description of an accessibility error and recommendations on how to implement a fix. (From [Bobby-03])

C. SIGGRAPH ONLINE

1. ACM SIGGRAPH

The Association for Computing Machinery (ACM) Special Interest Group on Graphical Display (SIGGRAPH) is a diverse group of researchers, artists, developers, filmmakers, scientists, and other professionals who share an interest in computer graphics and interactive techniques. The community is a cross-disciplinary organization. SIGGRAPH sponsors annual conferences, focused symposia, chapters in cities throughout the world, awards, grants, educational resources, online resources, a public policy program, traveling art show, and the SIGGRAPH Video Review. [Siggraph-03]

SIGGRAPH and their local chapters have already started using Web Portals, as shows in Figure 5 through Figure 7.

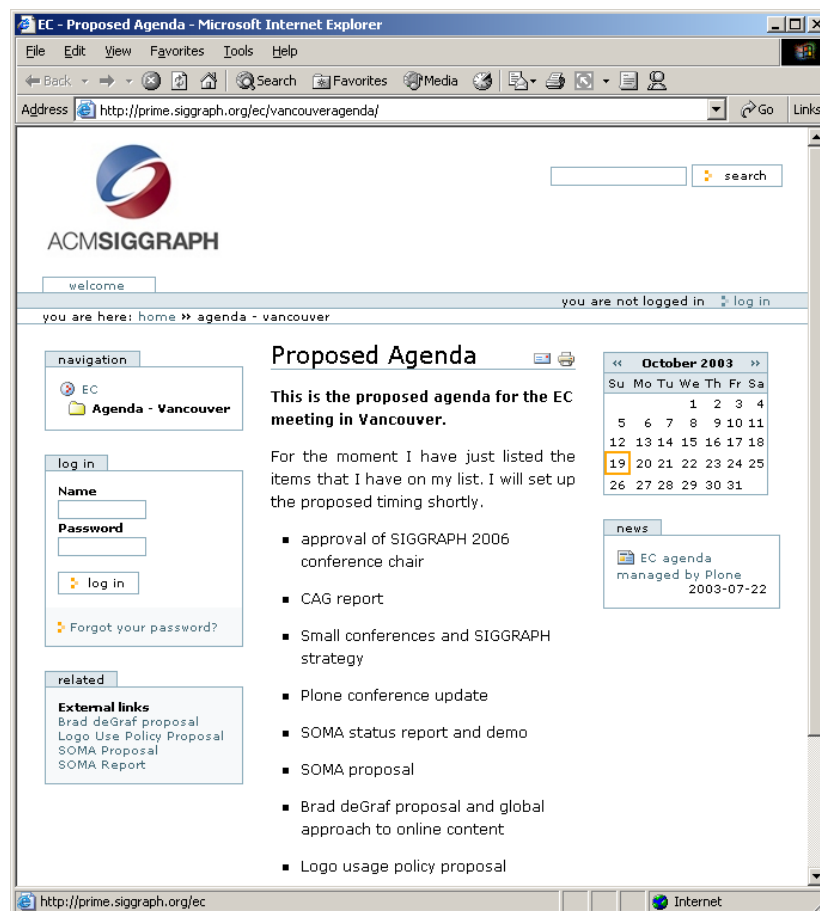


Figure 5. ACM SIGGRAPH portal powered by Plone (From [Plone])

The Montreal chapter of the ACM SIGGRAPH has designed its home page to accommodate both English and French speakers. Once a language is selected, each following page will be displayed in the language last chosen.



Figure 6. French version of the Montreal chapter of SIGGRAPH home page [ACM Montreal]

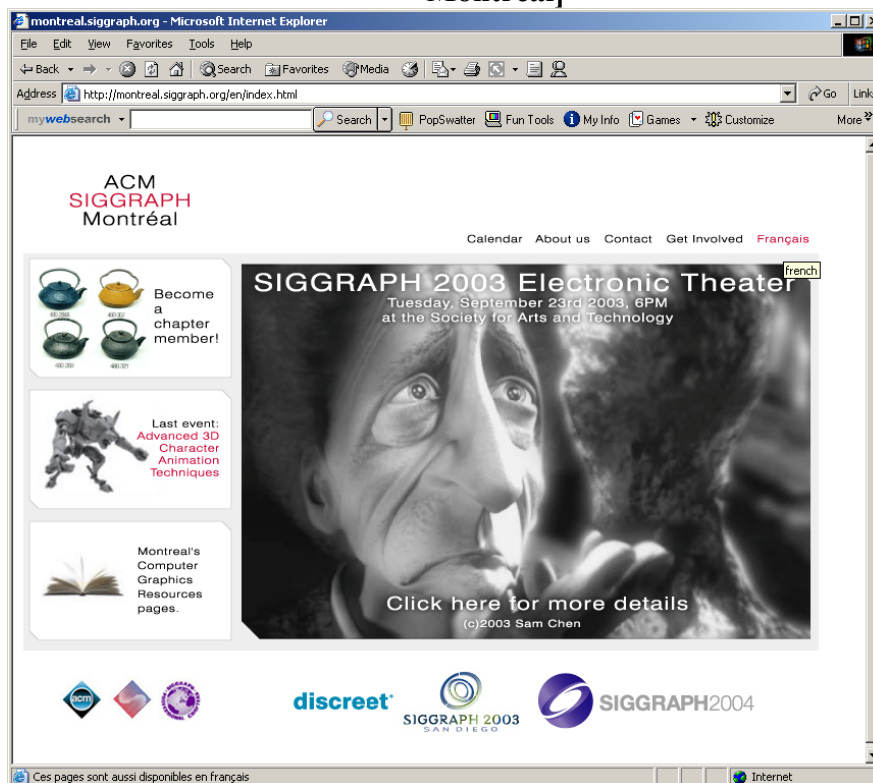


Figure 7. English version of the Montreal chapter of SIGGRAPH home page [ACM Montreal]

D. SHARABLE CONTENT OBJECT REFERENCE MODEL (SCORM) AND ADVANCED DISTRUBUTED LEARNING (ADL)

1. Advanced Distributed Learning (ADL)

The Advanced Distributed Learning (ADL) Initiative, sponsored by the Office of the Secretary of Defense (OSD), is a collaborative effort between government, industry and academia to establish a new distributed learning environment that permits the interoperability of learning tools and course content on a global scale. ADL's vision is to provide access to the highest quality education and training, tailored to individual needs, delivered cost-effectively anywhere and anytime.

By working with industry and academia, the Department of Defense (DoD) is promoting collaboration in the development and adoption of tools, specifications, guidelines, policies and prototypes that meet these functional requirements:

- Accessible from multiple remote locations through the use of meta-data and packaging standards
- Adaptable by tailoring instruction to individual and organizational needs
- Affordable by increasing learning efficiency and productivity while reducing time and costs
- Durable across revisions of operating systems and software
- Interoperable across multiple tools and platforms
- Reusable through the design, management and distribution of tools and learning content across multiple applications.

2. Sharable Content Object Reference Model (SCORM)

Sharable Content Object Reference Model (SCORM) is a standard that eases the portability between Learning Management Systems (LMS). SCORM also supports the reusability of objects. A SCORM compliant LMS is interoperable with any other SCORM compliant LMS. **[SCORM-02]**

The SCORM defines a Web-based learning "Content Aggregation Model" and "Run-Time Environment" for learning objects. It is a collection of specifications adapted from multiple sources to provide a comprehensive suite of e-learning capabilities that enable interoperability, accessibility and reusability of Web-based learning content. The

work of the ADL Initiative [ADL-03] is to bring together disparate groups and interests. This model attempts to bring together emerging technologies with commercial and public implementations. [Dodds-03]

The SCORM applies current technology developments to a specific content model by producing recommendations for consistent implementations by vendors. It is built upon the work of the Institute of Electrical and Electronics Engineers (IEEE) and others to create a unified “reference model” of interrelated technical specifications and guidelines designed to meet DoD’s high-level requirements for Web-based learning content. SCORM includes aspects that affect learning management systems and content authoring tool vendors, instructional designers and content developers, training providers and others.

SCORM contains two specifications: Content Aggregation and Run-Time Environment.

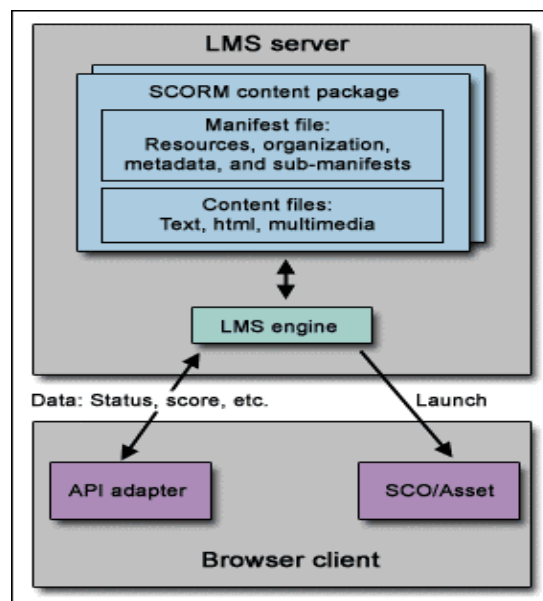


Figure 8. Illustration of the SCORM (From [SCORM-02])

a. SCORM Content Aggregation Model

The content aggregation model is how individual learning content is described and how a sharable and interoperable course is composed from the content. In SCORM, content is of three types: [SCORM-02]

- Asset — files that can be launched on a Web browser (text, HTML, Graphic Interchange Format (GIF), etc.).
- Sharable Content Object (SCO) — collection of assets, where one of them implements the prescribed methods to interface with LMS. The lowest level of granularity for learning content that is interoperable — any LMS can launch and track SCOs.
- Content aggregation — A structure to organize the sequence and navigation of content in a course (table of contents).

b. SCORM Run-Time Environment

The run-time environment specifies an Application Programming Interface (API) and data model for course packages to interface with the LMS. Each SCO must contain the specified interfaces to LMS. The Run-Time Environment specifies the three components of interfaces: **[SCORM-02]**

- Launch — Hypertext Transfer Protocol (HTTP) to start an asset or a SCO resource. Because a SCO needs to initiate communication with LMS, the SCO must contain methods to find the API adapter after it has been delivered to the Web browser. LMS has the responsibility of delivering the API adapter, which is a Domain Object Model (DOM).
- Application Programming Interface (API) — standard functions for a SCO resource to send status information (initialized, finish, error) and exchange (get and set) data. SCO resources initiate all communication to the API adapter, which in turn communicates with the LMS. The LMS does not initiate communications.
- Data model — data elements exchanged between the LMS and the SCO resource. The SCO resource can get and set only these data elements, and the LMS maintains the state of these data elements across user sessions.

c. SCORM Process

Figure 9 shows the process of delivering a course. The cycle ends when the LMS server has sent the last piece of content referenced in the content aggregation. **[SCORM-02]**

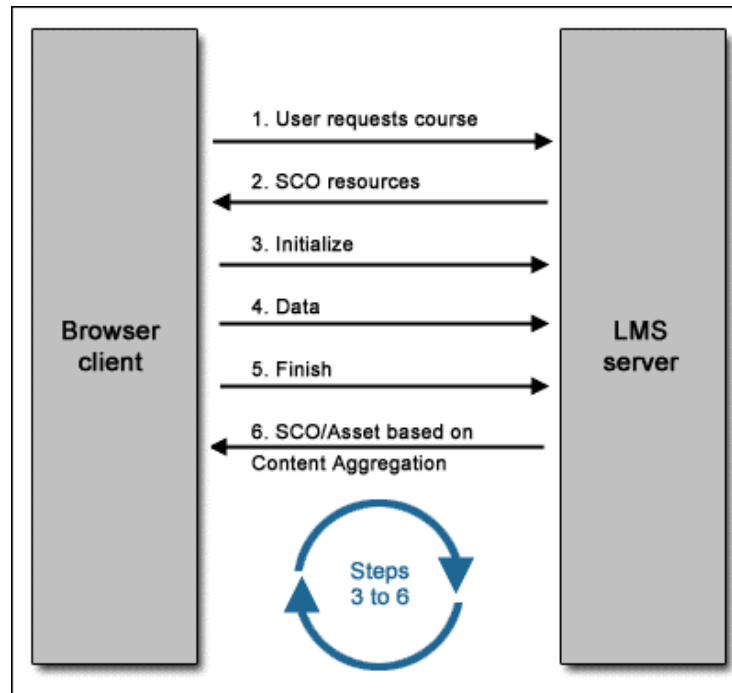


Figure 9. Process of delivering a course (From [SCORM-02])

E. MAILING LISTS AND HYPERMAIL ARCHIVES

Hypermail is a program that takes a file of mail messages in UNIX mailbox format and generates a set of cross-referenced HTML documents, allowing for online archive of mail messages. Each file that is created represents a separate message in the mail archive and contains links to other message, so that the entire archive can be browsed in a number of ways by following links. Archives generated by Hypermail can be incrementally updated, and Hypermail is set by default to only update archives when changes are detected. [Hypermail-03]

Each HTML file that is generated for a message contains (where applicable):

- Subject of the message,
- Name and email address of the sender,
- Date the message was sent,
- Links to the next and previous messages in the archive,
- Link to the message it is in reply to, and
- Link to the message next in the current thread.

Figure 10 shows a basic Hypermail web page.

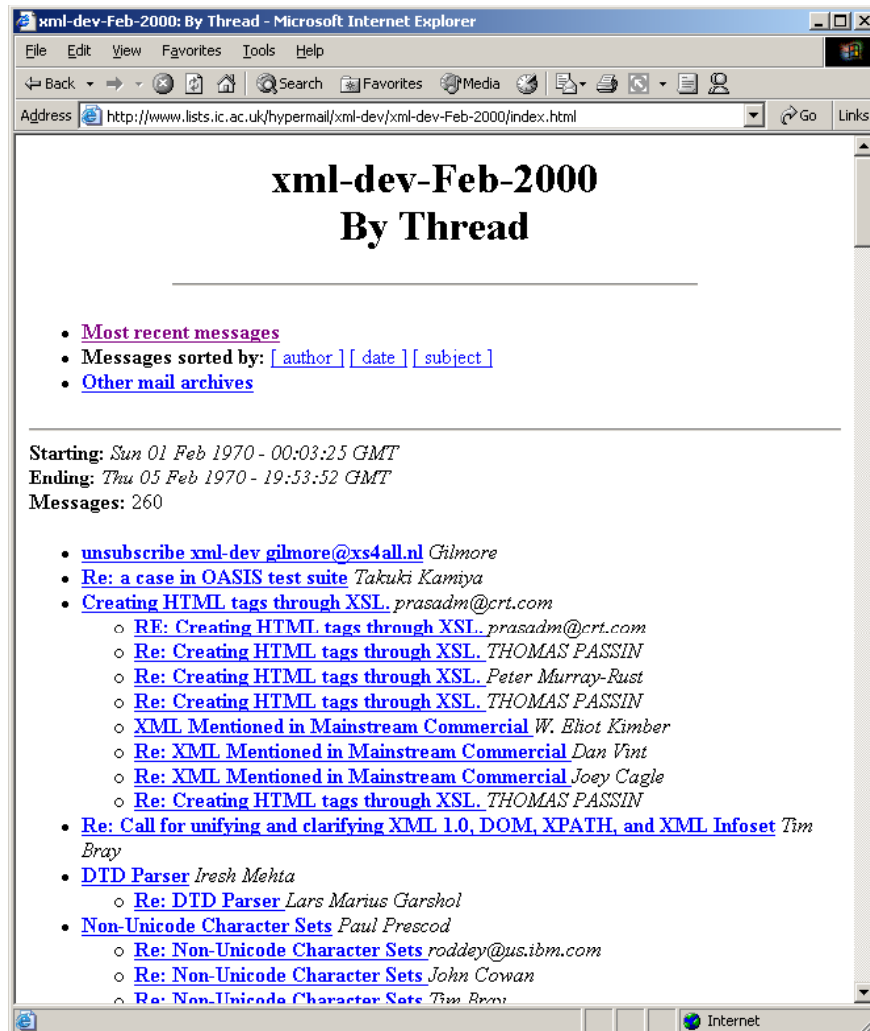


Figure 10. Hypermail web page example (From [Lists-00])

Hypermail also converts references in each message to email addresses, and URLs to hyperlinks so they can be selected. Email addresses can be converted to mailto: URLs or links to a Common Gateway Interface (CGI) mail program.

To complement each set of HTML messages, four index files are created which sort the articles by date received, thread, subject, and author. Each entry in these index files are links to the individual article to provide a bird's-eye view of every archived message.

Hypermail capabilities include:

- Hypermail archives can be updated incrementally by one message
- Archives and messages can be taken from standard input

- Archive indexes sorted by date received, thread, subject, and author are automatically generated
- "Next:", "Previous:", "In reply to:", and "Next in thread:" links in articles are automatically generated
- URL references in articles are converted to hyperlinks
- Email addresses are converted to hyperlinks - these links can go to mailto: or a custom-defined program
- Using the <html> tag, HTML passages in articles can be marked so they can be parsed
- Hypermail can take settings from a configuration file and/or environment options

GNU's Mailman is a recently announced set of free software for managing electronic mail discussion and newsletter lists. Mailman is integrated with the web, making it easy for users to manage their accounts and for list owners to administer their lists. Mailman supports built-in archiving, automatic bounce processing, content filtering, digest delivery, spam filters and more. **[GNU-03]**

F. WEB LOGGING (BLOGGING)

Blogging, or Web Logging, started out as the writing of online diaries. Blogs have evolved into a wide variety of formats from technical to news and commentary. It is a Website that usually has a single author and frequently has links to other blogs of interest to the author. It can be described as a radio talk show in a written column.

[Sullivan-02]

Blogs do two things that Web magazines don't. They are personal, reflecting the writer's personality. They also allow the author to write what he wants without interference from an editor, publisher or advertiser.

Currently, blogs are used for:

- Knowledge and sharing knowledge management
- Customer service
- Interactive journalism
- Communication
- Self-expression

- Learning
- Self-marketing
- Campaigning/social reform
- Community building
- Experience tracking
- Storytelling
- Evaluation of fringe ideas
- Elimination of the one-sided perspectives of established media such as newspapers and magazines
- Breaking down societal barriers to people and information
- Discussions in real-time

The future of blogging is intriguing. Imagine a blog author writing his daily thoughts, developing a following of readers, eventually compiling everything into a downloadable .pdf file book, and charging the user a small fee. The implications to the publishing industry are enormous. Unlike Napster, which was allowing users to download someone else's work, the blogger is creating his own material and bypassing the established system to get his writings published and distributed. Andrew Sullivan, a writer for Wired Magazine [**Wired-03**], began blogging by just jotting down his thoughts on a daily basis. He now claims to be reaching a readership of a quarter million readers, and making a profit. [**Sullivan-02**]

G. DYNAMIC HYPERTEXT MARKUP LANGUAGE (DHTML)

DHTML is a web technology that enables elements inside a web page to be dynamic. Things once considered unchangeable, such as text, page styles (font color, size etc), element position, etc., can be changed dynamically with DHTML.

[Dynamicdrive]

Dynamic Hypertext Markup Language (DHTML) is a collective term for a combination of new HTML tags and options that allow the creation of Web pages that are more animated and responsive to user interaction than previous versions of HTML. Simple examples of dynamic HTML pages would include having the color of a text heading change when a user passes a mouse over it or allowing a user to "drag and drop"

an image to another place on a Web page. DHTML can allow Web documents to look and act like desktop applications or multimedia productions.

DHTML can be thought of as a combination of three technologies held together by the Document Object Model (DOM): **[Traversa-00]**

- HTML – used for creating text and image links and other page elements
- CSS – Style Sheets for further formatting of text and HTML plus other added features such as positioning and layering content.
- JavaScript – Programming language that allows access and dynamic control of individual properties of both HTML and Style Sheets.
- DOM – A platform and language neutral interface that allows programs and scripts to dynamically access and update the content, structure and style of documents

Advantages of DHTML:

- HTML is not powerful enough to create interactive and multimedia-rich documents
- HTML cannot specify that text and images be located at exact coordinates
- HTML creates static and unanimated documents that limit the potential as an interactive multimedia format
- Can easily animate (including fade-ins & fade-outs) without a lot of hefty code slowing the page down. Can also simulate a Power Point-like slide presentation by calling up the next web page automatically.
- Features: Animations, games, applications, multimedia

Disadvantages of DHTML:

- There is still no pure standard that is shared equally between Netscape and Internet Explorer browsers, meaning what works with one, doesn't always work with the other.
- There are two different implementations: Netscape and Microsoft. A small, basic set of functionality is common to both, but differences appear in most areas. The significant difference is that Microsoft allows the content of the HTML page to be modified, but Netscape only allows the content to be manipulated.
- Only Versions 4.0 and above of the Netscape and Microsoft Web browsers support it.
- It usually requires a significant number of images to load, which takes longer. Fewer images can be used, relying on text fonts and elements. However, relying on the desired font being installed on the users machine can be a problem.

Figure 11 and Figure 12 show a demo of how DHTML can work. The user is given a set of tools to arrange in any order desired. The site does specifically note that this demo will only work on Internet Explorer, a known disadvantage of DHMTL.

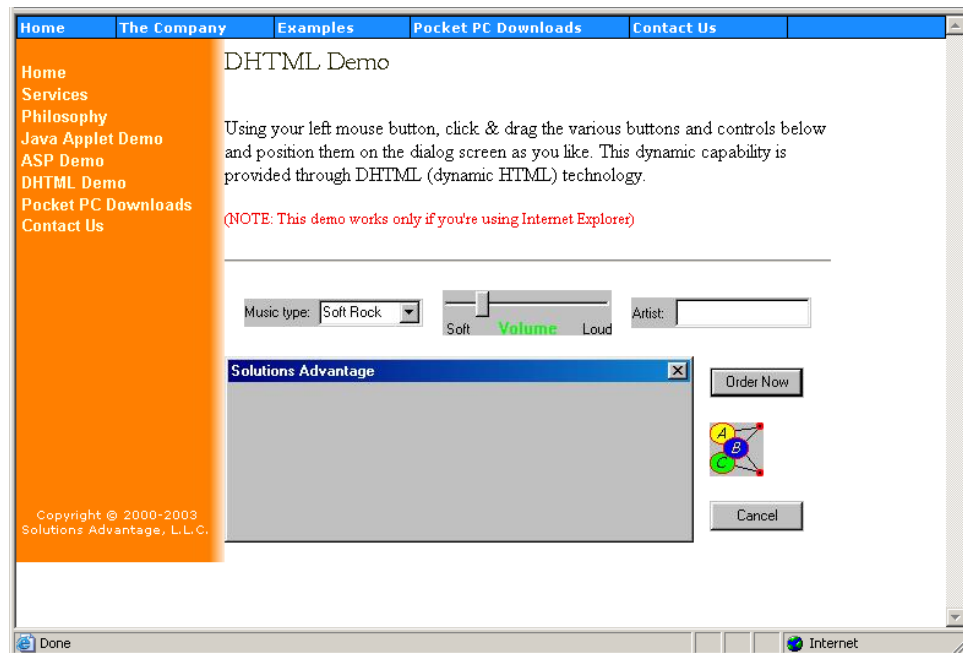


Figure 11. DHTML Demo (From: [SolAdv])

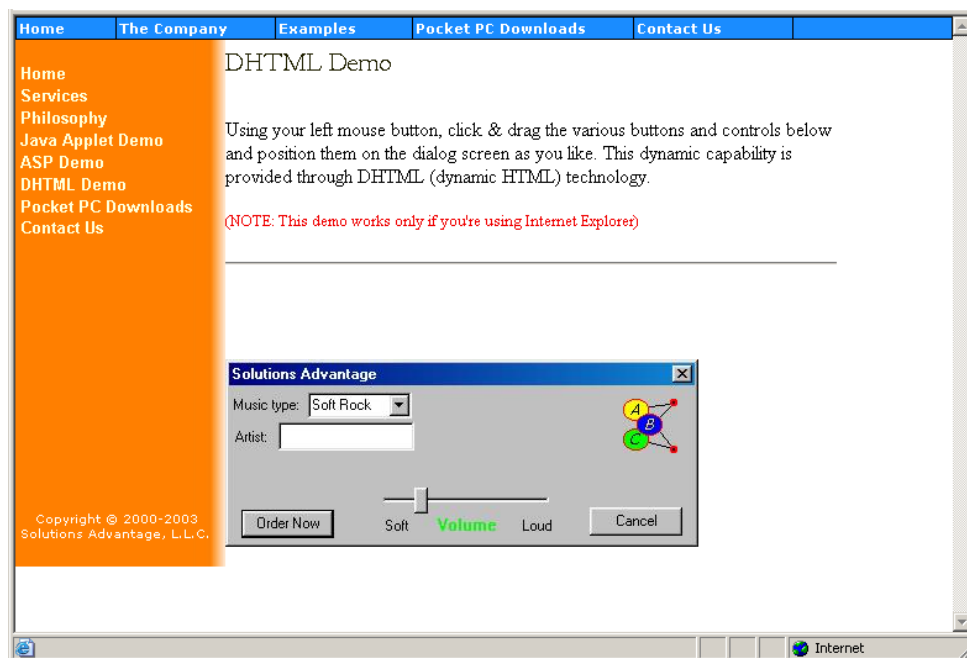


Figure 12. DHTML Demo – User designed (From: [SolAdv])

DHTML is presented here solely as a related work. Websites can achieve superior functionality and cross-browser standards based consistency through the use of Extensible HTML (XHTML) and related specifications.

H. KEY STANDARDS

1. Extensible Markup Language (XML)

Extensible Markup Language (XML) was derived from Standard Generalized Markup Language (SGML), and the first draft describing XML was created in 1996 by a group within the World Wide Web Consortium (W3C).

XML can best be described as a universal format for exchanging structured documents and data on the Web. XML is similar to HTML in that both make use of "tags." HTML is a fixed tag set, defining what each tag and its attributes mean, but XML is user defined, using tags to delimit bits of data and leaving interpretation of that data to the applications that read it. **[Biggs-01]** XML adds meaning to the content of a textual document. XML is not itself a markup language. Rather it is a metalanguage, used to create other specialized languages.

XML is made up of the following key categories: **[Matsumura-98]**

- **Structured.** XML documents use a DTD (Document Type Definition) for defining the syntax, grammar, and data structure of the XML document. A DTD also defines whether the use of each declared element is required, optional, conditional, and if a range of allowed attributes values is implied, had a default value, or is allowed to be empty. This allows the use of the DTD to determine if a document is well-formed (contains the properly defined tags) and is valid (conforms to the DTD in its entirety).
- **Self describing.** While XML documents are not required to be self-describing, descriptions add a level of power to Web automation and navigation. These descriptions are known as Metadata (data about data) and can contain information about document such as security, popularity, content, language, author, and any other description desired.
- **Extensible.** Extensibility refers to the ability to be expanded or customized. Since XML is not defined by a fixed set of tags, it is possible to add tags without breaking the standard. The tags are defined in the DTD, which formally defines what applications should expect in the structure of a document.

- Viewer adaptive. A useful offshoot of well-formed documents is that data can adapt to a variety of different viewing modes. Given the correct DTD for a data set, the content could go directly into a book format.

2. Extensible HTML (XHTML)

Extensible HTML (XHTML) is an XML encoding of HTML 4. XHTML is defined by the W3C, which also defines the various XML and HTML standards. While XML and HTML are derivatives of SGML, there are important differences. HTML is forgiving when it comes to tag placement, missing tags, and attribute values. A web browser will correctly interpret an HTML page even if the <HTML> and </HTML> tags are left out. The </P> tag to mark the end of a paragraph is not required. XML has strict rules about the format and use of tags, making it easier to parse XML documents. And more importantly, different XML parsers will interpret a given XML document in the same way. HTML parsers are not as consistent because the rules aren't as strict, which leads to differences in the way web browsers display pages. XHTML is the upgrade of HTML to be consistent with XML. It imposes XML's strict syntax on HTML and defines XML document type definitions (DTDs) covering HTML 4.01. Figure 13 and Figure 14 show the same document, first in HTML, then in XHTML: **[Giguere]**

```
<HTML>
<HEAD><TITLE>Hello World!</TITLE></HEAD>
<BODY>
  Hello world!
  <HR>
  Hello again!
</BODY>
</HTML>
```

Figure 13. Simple HTML document (From: **[Giguere]**)

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html
PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
"DTD/xhtml11-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head><title>Hello World!</title></head>
<body>
<p>Hello world!</p>
<hr/>
<p>Hello again!</p>
</body>
</html>

```

Figure 14. The HTML document transformed into a simple XHTML document (From [Giguere])

3. Extensible Stylesheet Language Transformations (XSLT)

Extensible Stylesheet Language Transformations (XSLT) is a declarative language designed for transforming the structure of XML documents either into other XML documents or other text.

XSLT makes the investment of time and resources into XML worthwhile. XSLT is stable, well implemented by dozens of open source tools, and powerful enough on its own to build applications for querying, retrieving, presenting, and exchanging data. Figure 15 shows a simplified concept of how XSLT works. XSLT is language for transforming the structure of an XML document. Restructuring XML is done for one of two reasons: [XSLT]

- **Presentation:** XML is about keeping formatting separate from structure. XML describes content, but provides no information about presentation. With XSLT, the elements to present can be selected, rearranged, and either output as a new XML document or to create an HTML document, a PDF file, an SVG graphic, a set of SQL instructions.
- **Interchange:** Data need to be transferable between systems. XSLT can transform metadata into objects or records that can be queried and incorporated into other repositories.

XSLT is a declarative language that defines rules describing the desired transformation. The stylesheet is a document containing the rules; the processor is a program that applies the stylesheet to the original XML document, or source tree, and

performs the transformation to produce the output document, or result tree. Figure 15 shows the basic process of applying a stylesheet to a document.

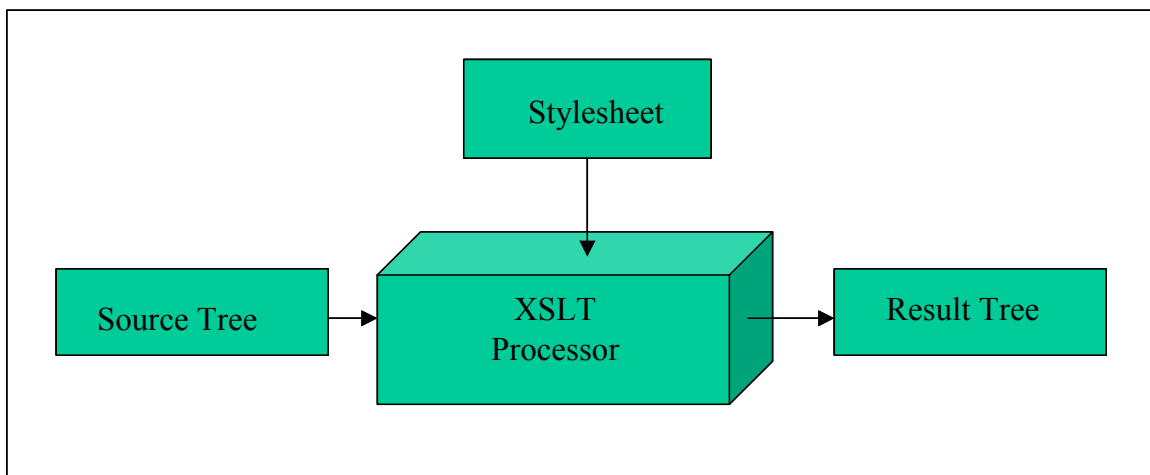


Figure 15. Basic XSLT process model where a Stylesheet is applied to a source document.

An XSLT stylesheet is itself a valid XML document, and must be well-formed. It contains special elements that are defined by XSLT and other formatting elements. Figure 16 shows a simple structure of an XSLT stylesheet. The XML document is matched to the stylesheet rules, or templates, to produce the output document.

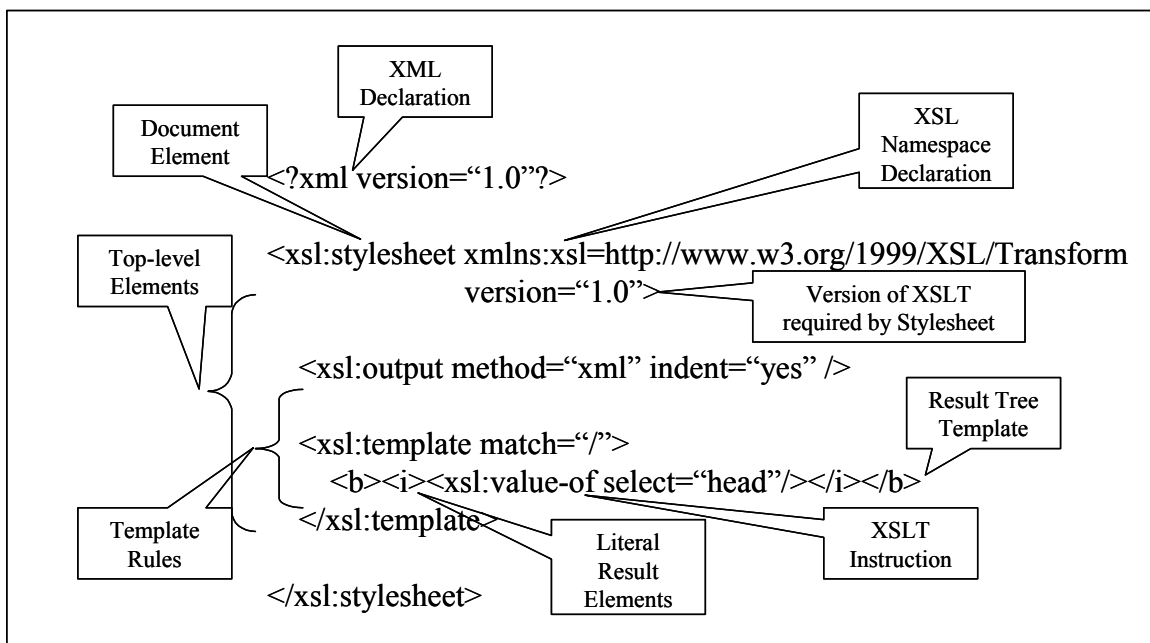


Figure 16. Structural overview of an XSLT stylesheet (From: [XSLT-03])

4. Portable Network Graphics (PNG)

Portable Network Graphics (PNG) is an extensible file format for the lossless, portable, well-compressed storage of raster images. PNG provides a patent-free replacement for Graphic Interchange Format (GIF) and can also replace many common uses of Tagged Image File Format (TIFF). Indexed-color, grayscale, and true color images are supported, plus an optional alpha channel for transparency. Sample depths range from 1 to 16 bits per component. **[PNG-03]**

For the Web, PNG has three main advantages over GIF: alpha channels (variable transparency), gamma correction (cross-platform control of image brightness), and two-dimensional interlacing (a method of progressive display). PNG generally compresses better than GIF, around 5% to 25% better. A GIF feature that PNG does not try to reproduce is multiple-image support, especially animations. PNG was and is intended to be a single-image format only. **[PNG-03]**

For image editing PNG provides a useful format for the storage of intermediate stages of editing. Since PNG's compression is fully lossless, saving, restoring and re-saving an image does not degrade its quality. **[PNG-03]**

I. SUMMARY

In this chapter Website design, SIGGRAPH Online, Sharable Content Object Reference Model (SCORM), Mailing Lists and Hypermail Archives, Web Logging (Blogging) and Dynamic Hypertext Markup Language (DHTML) are discussed. In addition, several key standards were explained. For additional information, refer to the list of references.

THIS PAGE INTENTIONALLY LEFT BLANK

III. WEB PORTALS AND WEB SERVICES

A. INTRODUCTION

The presentation of information on the Internet comes in different packages. The three primary presentation modes are Web pages, Webs Services, and Web Portals. A Web page can be compared to a picture. It is a snapshot of information at a given time. This currency of information is dependent on the site administrator to keep up-to-date. The Web Service extends the idea to provide a service. Retail sales sites are Web Services. The site administrators control the content of the site, but it is designed around a user, or customer. In order to purchase an item from Amazon.com, the customer must establish an account with relevant information. From there, the customer's information, and possibly preferences, are recorded in a database for future use. This allows the site to tailor itself to the user, though it is the administrators who decide how the customer's information will be used and what information will be provided. The site may even have dynamic links to other sites and services incorporated within. Web portals go beyond the idea of just a service. Portals allow the user to define how the site will be designed, choosing what information is desired, and what is not needed. This chapter introduces Web Services and Web Portals, how they differ, and the advantages of each.

B. WEB SERVICES DEFINED

A Web Service is a standard approach for making an application available to the outside world. The World Wide Web Consortium (W3C) [W3C] oversees Web Services standards and defines Web Services as:

A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically Web Services Description Language (WSDL)). Other systems interact with the Web service in a manner prescribed by its description using Simple Object Access Protocol (SOAP) messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards. [W3C-g]

Web Services are a self-contained, modular application that is described, published, located and invoked over a network. They are an Internet service that uses

Extensible Markup Language (XML) messaging system, independent of any particular operating system or language. With Web Services we go from a human-centric to an application-centric design. [Cerami-02]

Figure 17 shows the main components of a Web Service:

- Service Provider – makes the service available.
- Service Requestor – web service consumer.
- Service Broker or Registry – a directory.
- Publish – promoting a service to a registry, allowing it to be discovered and invoked by the requestor
- Find – jointly performed by the requestors and brokers, with the requestor describing what is wanted and the broker delivering the results that best match the request.
- Bind – between the requestor and the provider, allowing the requestor to bind to the service

Web services also support the following attributes: [Bieter-03]

- Reusability – based on the ideal of object oriented design, the code for Web Services are components that can be reused.
- Loose Coupling – the functionality is isolated from the client and accessible only through an interface.
- Discrete Functionality – is self contained and performs a single task.
- Programmatic Access – intended to be accessed by other programs.
- Internet Accessible – accessed over the internet using standard transport protocols.

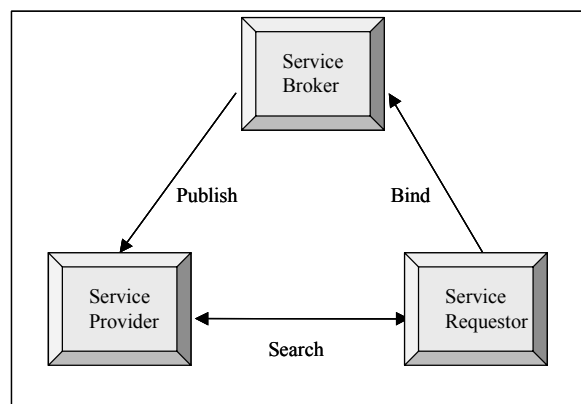


Figure 17. Function of a Web Service, showing the relationship between the three functional areas.

1. Evolution Of Web Services

Like any technology, Web Services have evolved over the years from the simple two-tier client/server model to the current Web Services model. [Invrario-03.1]

a. Two-tier Model

In a two-tier model, the customer bought a commercial off-the-shelf (COTS) inventory system that could be customized. The client and the server were contained on the same system and directly connected to the database. This was a very localized architecture. The client-server model is a simple two-tier approach to connecting users to data. By using this model, a client application makes a direct connection to a server containing the data needed by the program and typically will maintain that connection for the length of the client session. Figure 18 shows a two-tier client-server model.

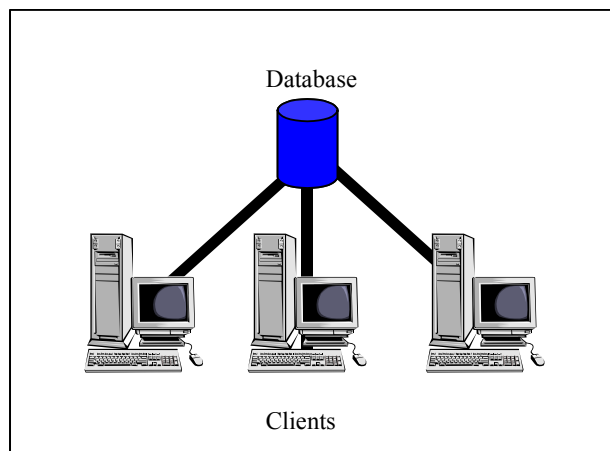


Figure 18. Two-Tier model. The client-server is directly connected to the database.

b. Web-based Application Model

In a web-based application model, the system is now connected through the Internet, making the database available to multiple clients from different locations through servers. The client is now a Web browser. Figure 19 shows a web-based application model.

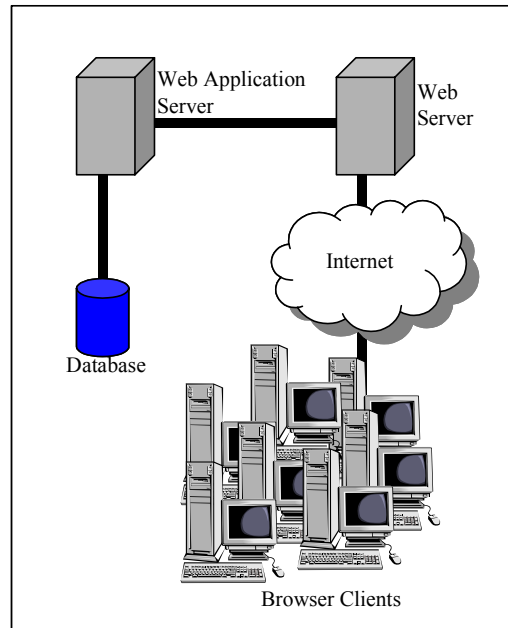


Figure 19. Web-based model. The client is connected to a web server, which then accesses the application server.

c. Web Services Model

In the Web Services model, the client is not necessarily a browser, and the operator is not always a person. The Web service may send a request to a series of other Web Services. Figure 20 shows a Web Services model.

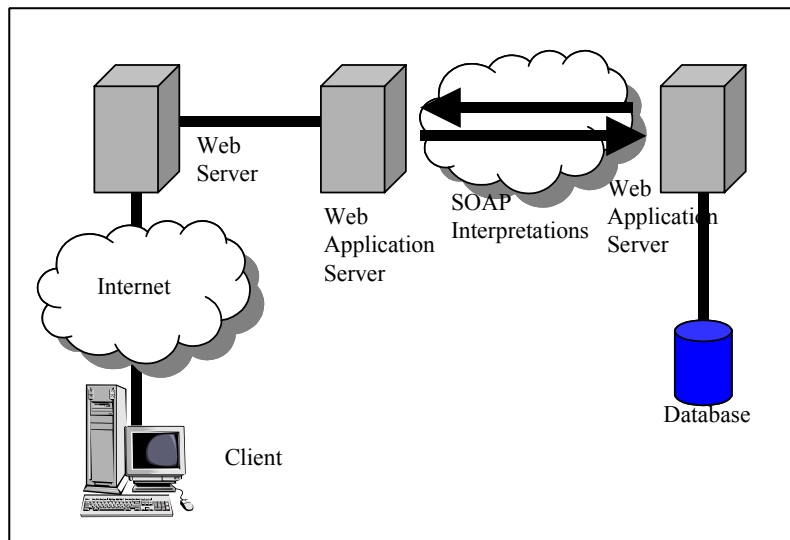


Figure 20. Web Services model. The client and the database are connected through layered Web Services.

2. Key Related XML-Based Technologies

There are four essential XML-based technologies that are involved in Web Services [Newcomer-02]:

- XML – the foundation for Web Services, it is the fundamental building block for passing messages between applications. A set of specifications controlled by the World Wide Web Consortium (W3C).
- WSDL – the language for describing a Web service, it defines interfaces, data and message types, interaction patterns, and protocol mappings.
- SOAP – the protocol for sending data between a requestor and a provider. A way for Web Services to communicate via messages in XML.
- Universal Description, Discovery and Integration (UDDI) – registry and discovery system used to store available services. Equivalent to the business white pages and a technical specification repository.

C. WEB PORTALS DEFINED

Web Portals are openings to user determined information, with the view in a single location even though the actual information is dispersed. Users log onto a page and customize it to suit their needs immediately. Michael Looney and Peter Lyman describe a portal as:

an epicenter of the web experience, a ‘home base,’ a place to return to when you get lost, a place to keep your information, a place from which to communicate with others, a security blanket or a safety net and a trusty guide to all things web. [Looney-03]

IBM defines a portal as “a secure, single point of interaction with diverse information, business processes and people, personalized to a user’s needs and responsibilities.” [IBM-02]

Portals are a gathering place for information and resources in a single location that helps both content providers and users manage the huge volume of data available. Within a portal are channels or portlets. The portal channel is a customizable page container where specific information or application appears, as shown in Figure 21. This small window within the portal may contain items such as weather data, news, search capability, reports, etc.

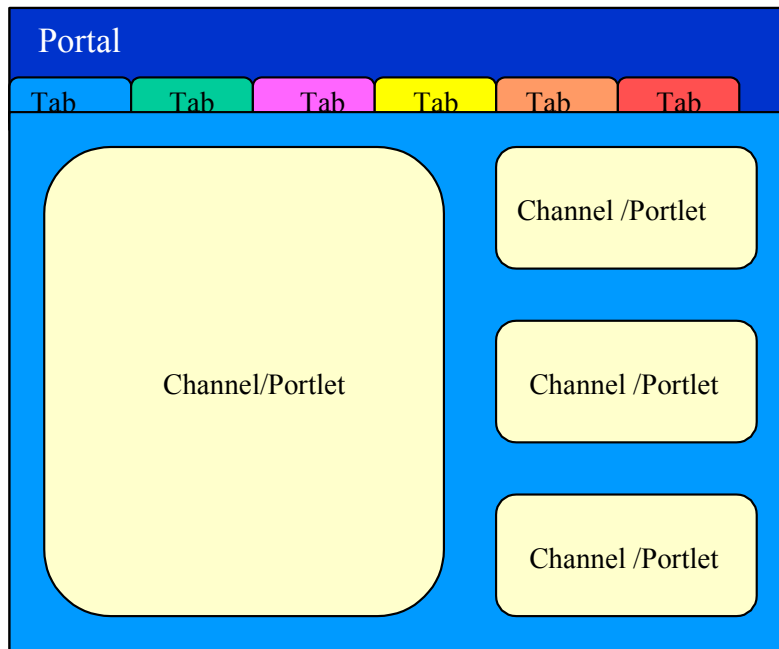


Figure 21. Basic Portal design. Multiple tabs (or pages) each contain multiple channels/portlets.

Web Portals provide: **[Eisler-03]**

- Access and Security
 - Gateway – system identifies approved users through a single sign-on procedure, alleviating the need to remember multiple user identifiers and passwords.
 - Security – users are allowed access to information they can see, change information they can change and no more. Those who should not see or change information are denied access to it.
- Information
 - Customized information – allows the user to create the portal to suit his needs. Users may select features from a provided set or create their own portlets (a portal within a portal).
 - Channel information – provides information from internal and external sources (weather, news, sports).
 - Pushed information – the site owner, and users to a lesser extent, can select which constituencies should receive which information (e-mailing to all personnel, to particular departments, to individuals with specific interests, announcements, calendars).

- Functionality
 - Personalization – users edit the portal’s look and some sources of information available on it.
 - Internet tools – search and navigation engines for intranet, web pages and the entire Internet. Tools to save favorite Websites, create home pages, and create/post message boards.
 - Personalized tools – users can create planners, calendars, to-do lists, web and home pages.
- Communications
 - Interaction – interfaces for chat, e-mail, address books, threaded discussion, message boards and bulletin board postings.
 - Schedule meetings – interactivity for calendars, manage meetings for staff.
 - Electronic balloting – voting, survey functions, polling capability.
- Integration
 - Workflow and application integration – staff can access data/applications needed to do their work in a real-time environment, creating personalized data reports and tracking indicators; contact/project management systems.

Web Portals can be divided into five basic categories: **[Looney-03]**

- Consumer Portal – examples include sites such as AOL and Yahoo! They are also referred to as Mega Portals. Provides shopping, news, weather, stock information. Authentication is rare.
- Community Portal – characterized by its design around a specific topic of interest. An example of a community portal is BabyCenter **[BC]**, designed for pregnant women and new mothers.
- Vertical Portal (Vortals) – similar to a Community Portal, the Vortal is for more narrowly defined subjects. A familiar portal used in education is the Blackboard **[Bb]** Site.
- Enterprise Portals – corporately based portal, it may be either horizontal, covering the breadth of information of the enterprise, or vertical, covering a specific interest.
- Business to Business (B2B) Portals – a special type of Enterprise Portal for business to business sites which buy and sell with each other, as a marketplace.

D. EXTENSIBLE MODELING AND SIMULATION FRAMEWORK (XMSF)

XMSF is a framework of profiles for use of existing standards rather than an architecture of specifications. Its purpose is to tailor a set of selected standards, provide data and metadata standards, and provide recommendations and guidelines for implementation. The intention is to apply, rather than replace, open standards rather than to replace, and to broaden existing standards through the use of existing technologies such as Web Services, XML, and SOAP.

The XMSF framework is intended to create a basis and initial requirements for transformational interoperability, founded on the following precepts: **[XMSF-03]**

- Web-based technologies applied within an extensible framework will enable a new generation of Modeling and Simulation (M&S) applications to emerge, develop and interoperate.
- Support for operational tactical systems is a missing essential for existing M&S applications frameworks.
- An extensible XML-based framework can provide a bridge between forthcoming M&S requirements and open/commercial Web standards.
- Compatible, complementary technical approaches are possible for model definition, simulation execution, network-based education and training, network scalability, and 2D/3D graphics.
- A Web approach for technology, software, content, and broad use provides best business cases from an enterprise-wide perspective.

XMSF provides a framework to take advantage of Web-based technologies. Such a framework aids M&S applications to interoperate, as well as enable M&S development. XMSF is a kind of wrapper intended to give you a better handle on what's needed to support web-based M&S interoperability. You can certainly function without the wrapper, but the XMSF wrapper provides a framework for integrating technologies.

In an example application, XMSF uses web-based communication protocols, SOAP and Blocks Extensible Exchange Protocol (BEEP), to allow a High Level Architecture (HLA) compliant simulation to communicate with the HLA Run Time Infrastructure (RTI) over the Web. As has been demonstrated many times, standard HLA federations can be run on a Local Area Network (LAN). However, the implications of running HLA federations via Web Services are enormous. The positive impact on lifecycle costs and availability can be significant: **[Morse-03]**

- Legacy simulation may be made available without moving its dedicated hardware or trying to create a new installation on potentially rare hardware, both very expensive propositions.
- The simulation can stay home-based with its technical support and configuration management.
- There's no switching between supporting different federations at different times.
- Web enabling federates is a required step forward for enabling rapid composability of simulations to support the operational warfighter.

E. SUMMARY

Web Services are the glue that brings organizations together, while portals provide a dynamic depth to Web Services. Portals bring together disparate applications, while Web Services are for publishing functionality in a standardized way. For the Portal, the Web Service is a content provider. Since Web Services have a standardized interface (WSDL) and messaging scheme (SOAP), Portals are able to automate much of the work to bring in and connect applications.

Advantage of Web Portals include:

- more robust content because it is drawn from multiple sources.
- provide faster tools to locate information and services relevant to the user (search engine, taxonomy-based directory, personalization, organizational directory).
- greater currency on the latest content (news services, dynamic publishing, what's new).
- far more organizational, controlled and process based.
- provide multiple paths to the same information versus having to know a single "right" path to the information.
- provide a familiar environment, isolating the user from details and system changes.

Table 1 summarizes comparative features of Web Services and Web Portals.

Web Service	Web Portal
Institution-Centric	User-Centric
The same for everyone	Customized by each user
No personalization	Personalization
Start to surf the web from here. The stuff that everyone needs is just a few clicks away (assuming you can find it)	The most important data and applications the user wants are immediately available
The authors change it when they want to.	The user changes it when he wants to

Table 1. Web Pages vs. Portals, a comparison.

While a Portal can be far more advantageous to the user, often a simple home page will still be needed. Outsiders may want to access some basic information without logging into a Portal. The best solution may be a combination of services.

IV. OPEN SOURCE PORTAL SOFTWARE

A. INTRODUCTION

A portal can be defined as a "gateway to web access" or "a hub from which users can locate all the web content they commonly need" [Strauss-00]. Strauss lists several mandatory features of a portal: personalization, search, channels, and links. The desirable elements are customization, role-based models, and workflow.

In this chapter, three open source portal development tools are reviewed: Jetspeed, Plone, and uPortal. These tools were chosen based on being open source and prevalence of use.

B. APACHE JETSPPEED

The Apache Software Foundation (ASF) provides support for the Apache community of open-source software projects. The Apache project is a community of developers and users that is a collaborative, consensus based development process, an open and pragmatic software license, and a desire to create high quality software that leads the way in its field. One of the projects is Jetspeed, an open source implementation of an Enterprise Information Portal (EIP) using Java and XML. Jetspeed acts as the central hub where information from multiple sources is made easily available. [AJP]

Jetspeed focuses on building connections to outside resources like Web Services, databases and content feeds. Features include user interface customization, caching, persistence, and user authentication. This allows the designer to concentrate on retrieving and displaying data.

Jetspeed is built on top of Turbine, an open source application framework from the Jakarta Apache Project. It can sit on various servlet runners and databases. Tomcat is the most commonly used servlet runner, which also acts as a Web Server, eliminating the need for an additional HTTP server.

Jetspeed is not provide a suitable development platform in its current state and the dependencies upon existing large over-extended software is too high. [Novotny-03]

Jetspeed is full of promise, but is difficult to learn. Open source has a mantra of release early and often, and it's still quite early. Installing Jetspeed can be frustrating. Jetspeed requires the installation of Tomcat, Ant, Java Development Kit (JDK), and a Simple Mail Transfer Protocol (SMTP) server. None of these are bundled with the Jetspeed installation.

Jetspeed uses XML extensively for display and back-end functionality, including use of Resource Description Framework (RDF) Site Summary (RSS) feeds and XML data into portlets and Wireless Application Protocol (WAP) cell phone site delivery. The Portal Structure Markup Language (PSML) is used to store portal-specific information including styles, personalization information and portlet registries.

The documentation is fairly good overall, with a tutorial for the 1.4b3 release. There are also Frequently Asked Questions (FAQs), sample sites, Javadocs, and other information readily available through the Jetspeed home page.

Jetspeed does offer some useful features. The administrative interface is intuitive. Content can be syndicated and syndicated content can be accessed as portlets. The primary software will be standardized on the portlet specification, enabling absorption of third-party portlet applications. Currently, numerous types of applications can be integrated as portlets including: RSS, Java Server Pages (JSP), servlets, external Web page, XSL, Velocity, a database browser, and more. It is also highly portable between Java 2 Enterprise Edition (J2EE) servers using the JDK 1.2 and Servlet 2.2 specifications. **[Falkman-03]**

A weakness with Jetspeed is customization. Customizing Jetspeed requires not only knowledge of J2EE programming concepts, but also the Turbine application framework. Building applications on top of existing frameworks fine, but not knowing Turbine significantly adds to the learning curve.

Figure 22 is a sample of a basic Jetspeed portal.

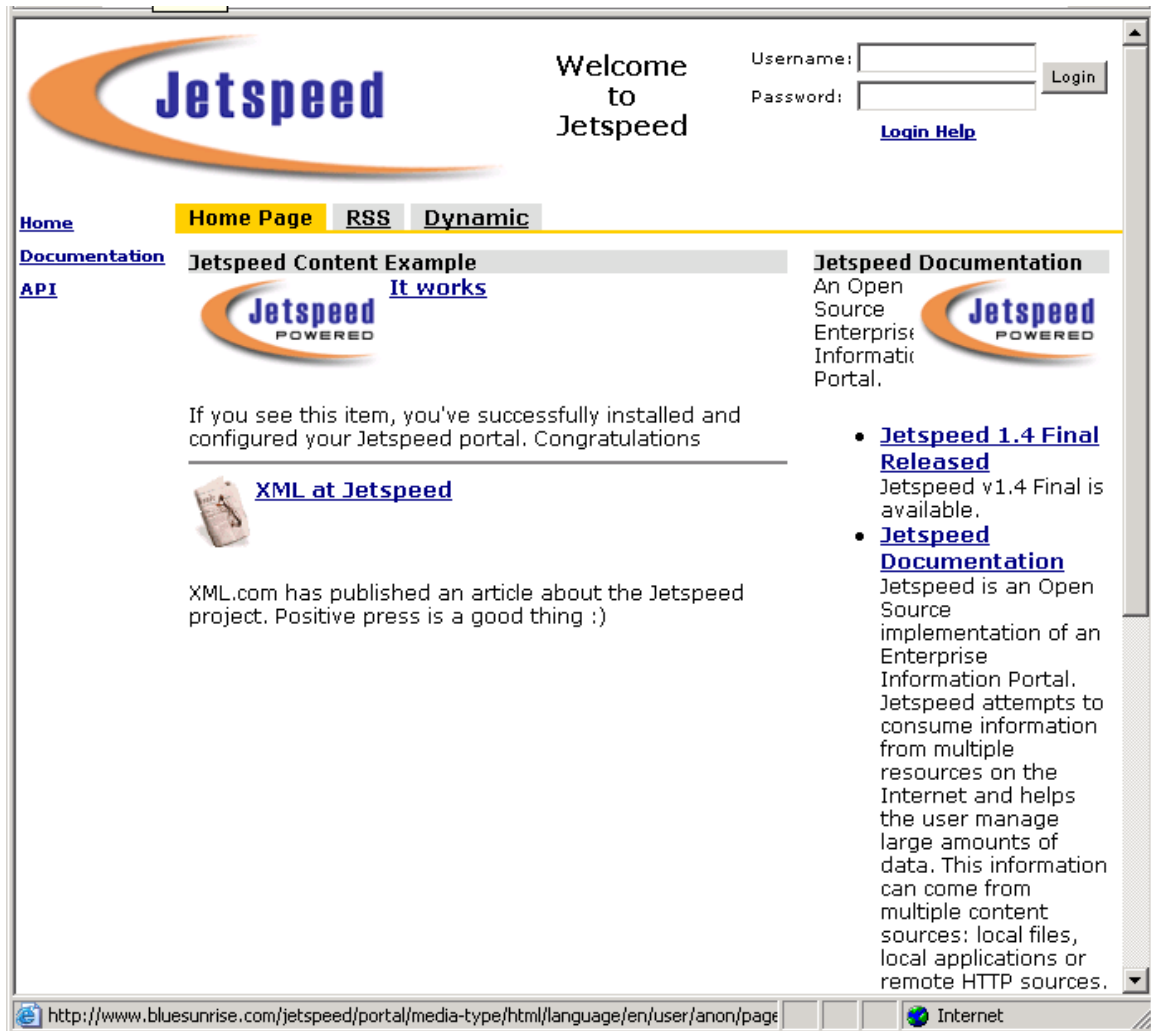


Figure 22. Sample Jetspeed page. The default page as it loads when first installed.

C. PLONE

Plone is built on top of Z Object Publishing Environment (ZOE). ZOE, a Web Application Server, can be used to publish "objects" on the web. These objects can be plain text, structured content or anything else that can be put on the web. It provides an excellent framework for developing web applications, and is best with content management. [Gerasappa-02]

According to Jim Rapoza at eWeek, Plone is "quite possibly the most easily deployed server application we've ever seen, open-source or commercial." [Rapoza-03] Plone is a powerful interactive portal environment, contains excellent content and

publishing options and very easy to install and use. Its major downfall is its limited documentation and it is not well suited to high-end site content.

Content management process benefits include **[Plone]**:

- Manage from anywhere. Accessible from all kinds of web browsers, even a mobile phone.
- Live editing. Updated from within the site itself.
- Designed for usability. Usable with minimal training.
- Limited use of graphics. A main goal is minimal use of graphics.
- Facilitates collaboration. When editing and publishing content, you can assign other participants local roles within projects.
- Easy management and configuration. The administration and configuration of Plone is done through the web. File system access is not needed after the system is set up.
- Single sign-on. Plone has a centralized sign-on which prevents users from having to log on to each area separately. Security is controlled centrally.
- Accessibility. Consideration is given to access for users with disabilities.
- Encourages ownership. Users can edit and add content to give them the feel of ownership. This leads to more people using the Internet and intranet actively.

Technical benefits include **[Plone]**:

- Powerful pluggable workflow system. Plone has built-in support for administrative workflow and approval mechanisms. It supports both action-based and entity-based workflow paradigms, and has a pluggable architecture to allow you to plug in your own workflow systems, if required.
- Modular, easy to expand, reusable components. Both the programmatic logic and the user interface construction can be reused extensively in your custom project, which means that you get code reuse and a consistent look across different parts of the application.
- SQL connectivity. All the major databases are supported.
- Easy to create new content types. By repurposing existing content types, you can easily generate your own custom content types without any programming skills, and if you want to write richer content types with advanced behaviors, you can do this with the Archetypes add-on.
- Lightweight Extensible Hypertext Markup Language (XHTML). Makes a mobile phone connection or directly from a mobile phone browser possible.

- Fully indexed, powerful search engine. All content in Plone is indexed and searchable.
- Activation date and expiration dates. Every content item has attributes that control its lifespan, and ensures that the content is posted and retired on time.
- Topics and Topic Map technologies. To enable efficient aggregation of content, you can use hierarchical topic systems to help you grow the knowledge in the system while maintaining structure and control.
- Powerful template system. Plone utilizes the industry's first XML standards-compliant templating language, Zope Page Templates (ZPT). This templating system works well with a wide range of editors, including visual web editors like Dreamweaver.

Figure 23 and Figure 24 depict sample Plone Web Portals.



Figure 23. An example experimental Plone portal designed by SIGGRAPH (From: [SIGGRAPH-03])



Figure 24. Sample Plone page. The Plone homepage (From [Plone])

D. UPORTAL

Numerous institutions (Princeton, Yale, Cornell, Notre Dame and others) joined together and formed the Java in Administration Special Interest Group (JA-SIG). The participants defined the following requirements for a common portal reference framework [Gleason-01]:

- access to all information and services through a single graphical interface
- single log-on
- framework where all elements of the university and all business applications can be integrated
- convenient set of Web-based communications services
- one-stop place to perform all business transactions

- ability to present information and access to services on an individual basis in a personalized manner
- ability to customize the appearance, layout, and content
- give university full control and management of appearance and content
- vendor independent
- free of commercialism
- available 24/7
- flexible and able to absorb new technology advances and new applications.

Although it is an immature product with some flaws, the issues are being rapidly addressed and should not be obstructive to moving forward. Using a portal that is an open source product allows for easier and broader redistribution of the portal infrastructure, leading to more effective collaborative efforts.

uPortal is a framework, a set of technical specifications, and software. The framework provides a J2EE portal server (container) and well-defined interfaces that will permit individual institutions to customize the institutional portal by plugging in components in a well-defined and usable manner. The portal specification provides single sign-on plug-and-play, providing ease of use, removing the need to sign-on each time an application is accessed and the ability to implement single sign-on in a way appropriate to the situation. The portal specification defines interfaces for content suppliers (publishers), allowing for smooth integration of channels and applications.

The underlying model is based on a management structure of publish and subscribe, in which all members of the campus community both provide and consume content of interest to the community and to themselves. This structure includes enterprise applications, channels, publications, and links. All publications (content) go through a construct, assuring proper approval. A working group of JA-SIG members is defining and publishing the detailed specifications of the framework.

As uPortal becomes more feature-rich and is adopted by colleges and universities as an institutional information portal solution, there will be a need for a permanent support structure and the inclusion of stronger administrative functionality in future releases of the product.

There is a high level of support for uPortal within the higher education information technology community. uPortal adheres to open standards and is consistent and complementary with other major open initiatives. uPortal is supported by a major grant from the Andrew W. Mellon Foundation.

The use of the open source model, the sharing of resources and components, and the potential to drastically reduce costs are very appealing. For vendors, uPortal provides a set of channel standards to which application developers and commercial application vendors can write a standard, one-time-only interface, thus further eliminating both institutional integration and vendor development costs.

Figure 25 is a sample uPortal page.

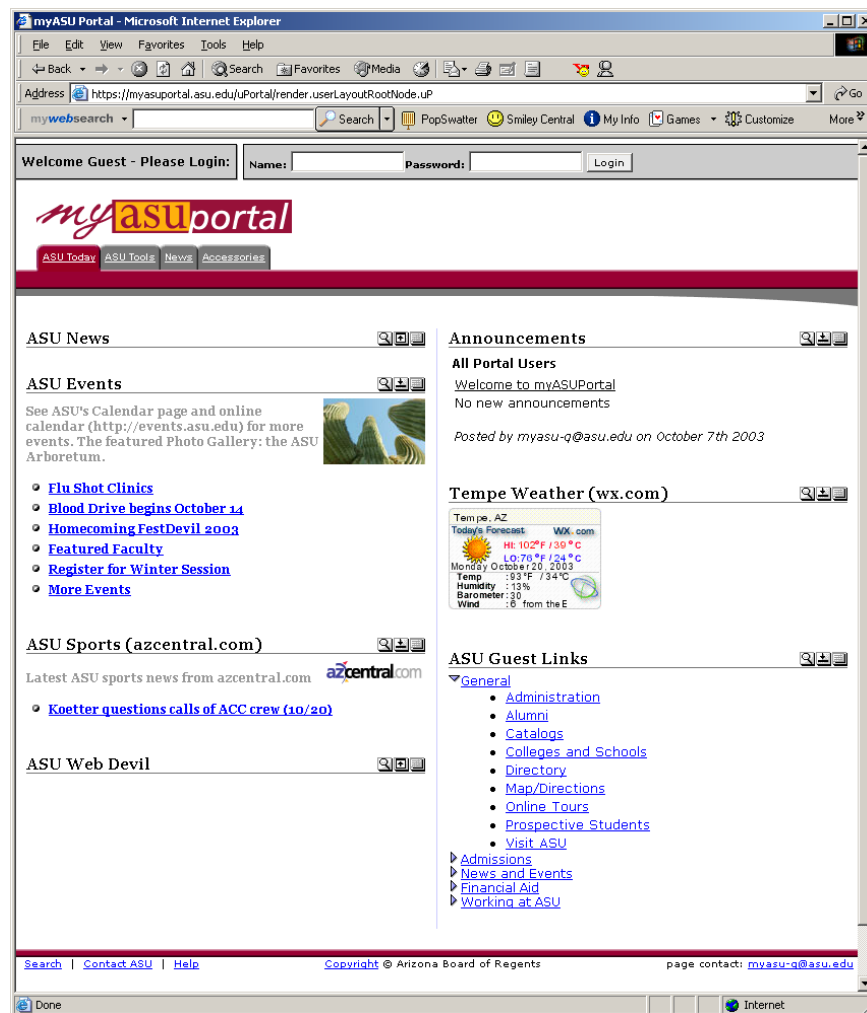


Figure 25. Sample uPortal design, Arizona State University portal (From [ASU])

G. SUMMARY

A significant issue in the design of any product is the selection of the tools to use. All three of the open source portal development tools are highly effective. When choosing the right tool, consideration must be given to the skills of the personnel who will be maintaining the service. Jetspeed, while a very versatile product, is a difficult tool to master and requires significant skill and training to use effectively. Plone is easier for the administrator to maintain, but comes with corresponding limitations with that ease of use. uPortal is an intermediary tool that is easier to learn and use than Jetspeed and provides more capability than Plone. An evaluation of the skill sets currently available, and anticipated is needed before any selection of portal software is made.

THIS PAGE INTENTIONALLY LEFT BLANK

V. NAVAL WEB PORTAL DEVELOPMENT

A. INTRODUCTION

This chapter assesses the Task Force Web's work in Enterprise Portals and examines the portal development done by FNMOC and Navy Knowledge Online. These areas were chosen due to their extensive work in the area of Web portals.

B. TASK FORCE WEB (TF WEB)

Task Force Web (TF Web) is a Vice Chief of Naval Operations special project established to set standards for Navy Web enablement and to implement infrastructure to support Web Services. **[Barrett-03]** Their mission is "to provide integrated and transformational information exchange for both the ashore and afloat Navy to take full advantage of Navy's IT 21 and NMCI infrastructure investment." **[TFW-03]**

Some of the areas that TF Web is focusing are described in the following sections.

1. Navy Enterprise Portal (NEP)

The Navy developed the Navy Enterprise Portal (NEP) to provide an easy place for accessing Web services through a common user interface. The user's experience is an important element of the infrastructure, providing a common "look and feel" for the user. The NEP is the gateway to these capabilities and information. **[Barrett-03]**

Figure 26 through Figure 28 show how a potential recruit can use a NEP to create his own personal "Navy Locker" to access information about a Naval career.

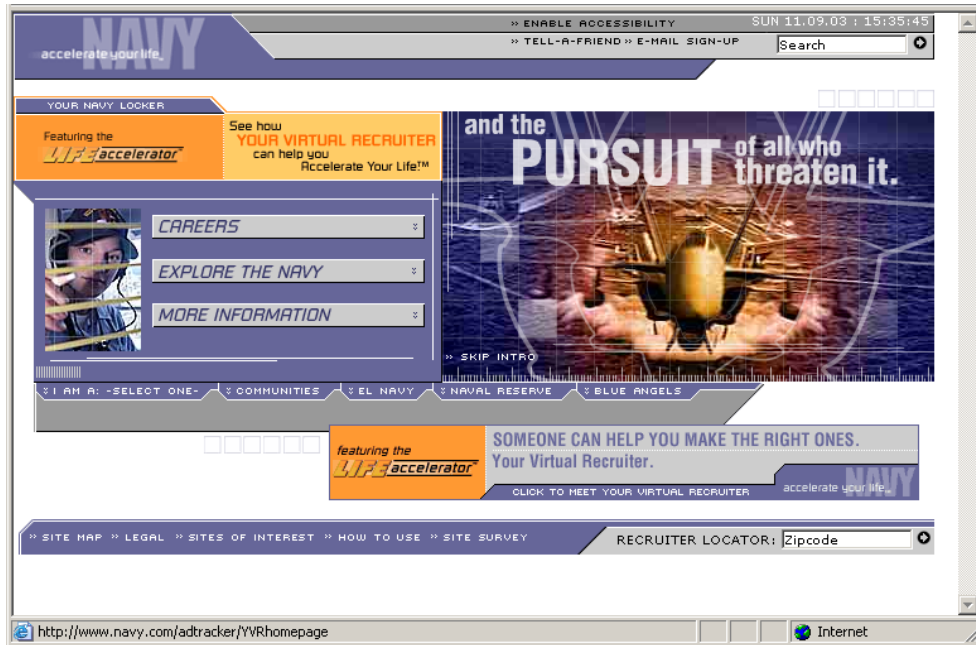


Figure 26. Entrance to the portal for the US Navy’s recruiting site. The potential recruit enters here to begin an exploration of what the Navy has to offer. (From www.navy.com)

Figure 27. Creating a Navy Locker. The interested potential recruit can create his own “Navy Locker” to discover what the Navy is about. (From www.navy.com)



Figure 28. The potential recruit's "Navy Locker" Here he can keep track of the topics and resources of interest. (From www.navy.com)

Currently the Navy has no common solution for providing Web data services and content storage. Each command pays individually for services and support either through contractual vehicles or within their organization. This is highly inefficient both operationally and fiscally. Data warehouses could be managed by Naval Computer and Telecommunications Area Master Stations (NCTAMS), resulting in significant savings in manpower and dollars, improved security, easier implementation and elimination of duplicate data sources.

2. Single Sign-on (SSO)

The objective of the Single Sign-on (SSO) are to allow each user to log on once, and have that identification and certification follow him through multiple security domains.

The SSO solution is currently being developed by numerous and disparate groups within the Navy. Most of these efforts are application specific solutions. TF Web has done extensive testing on industry-standard compliant solutions and has a SSO solution implemented with the NEP. The Secure Access Markup Language (SAML) for inter-domain SSO is continuing to be refined by the standards bodies, and TF Web has selected a commercial product for the enterprise solution that complies with this standard. TF Web is working with the Fleet Numeric Meteorological Oceanography Center (FNMOC) on this issue in an effort to lower lifecycle cost. **[Barrett-03]**

3. Universal E-Mail

The goal of Universal E-mail is to provide Navy and Marine Corps personnel with a universal e-mail address that they keep "cradle to grave" to ensure continuous communication between duty stations. The Universal E-mail address (i.e. john.doe@navy.mil) would follow the individual throughout their career and into retirement. Users would be able to forward their e-mail using a Web-based SMTP redirect service via the NEP to a local Microsoft Exchange account without ever having to change an e-mail display address. **[Barrett-03]**

D. NAVY KNOWLEDGE ONLINE (NKO)

NAVADMIN 016/03 announced the Navy Knowledge Online (NKO), the Naval Education and Training Command's (NETC) integrated delivery system for lifelong learning initiatives, personnel development and knowledge management. Initially focused on the Naval Personnel Development Command (NPDC) and the various learning centers, NKO will eventually support the growth and development of all Navy personnel. Effective 24 January 2003, access to NKO was made available to all active duty, reserve, and retired sailors and marines, as well as all navy department civilian

personnel. NKO can currently be accessed directly on the web and planning is underway to enable access via NEP in the near future. NETC, which oversees the training and education opportunities for the Navy, deployed NKO in August 2002 and now has over 165,000 users. **[ebiz-03]**

The Task Force for Excellence through Commitment to Education and Learning (EXCEL) was established to implement a revolution in training. NKO (Figure 29 and Figure 30) came out of the report from the Executive Review of Naval Training (ERNT). As described in the ERNT report:

Upon arriving at boot camp, Recruits will be provided with a Personal Portable Webpage (PPW) - a web page that acts as a professional portfolio and educational portal. The PPW will include an individual's training history, educational transcripts, past and current assignments, important e-mail addresses, bookmarks to important web pages, links to eLearning, and so on. In terms of career enhancement, the PPW will be populated by the personal career plan and the learning plan for each new Sailor and will be developed and updated at important career milestones with the Sailor's supervisor/mentor. At each mentor handoff, the Sailor's PPW will also be updated with information concerning recent duty, accomplishments, training, and so on, and a learning plan revised for the Sailor and his or her next mentor to use as a reference. The PPW is similar in concept to the personalized Webpages provided through many Internet service providers, such as My Yahoo or My Lycos. **[NKO]**

The Personal Portable Webpage described in the ERNT has become Navy Knowledge Online.

NKO provides the means to:

- Connect sailors with information, expertise and learning opportunities required to support their professional and personal development
- Engage in real-time and asynchronous collaboration with peers, mentors and subject matter experts around the world.
- Track individual training requirements and the progress of each sailor in accordance with their five-vector model

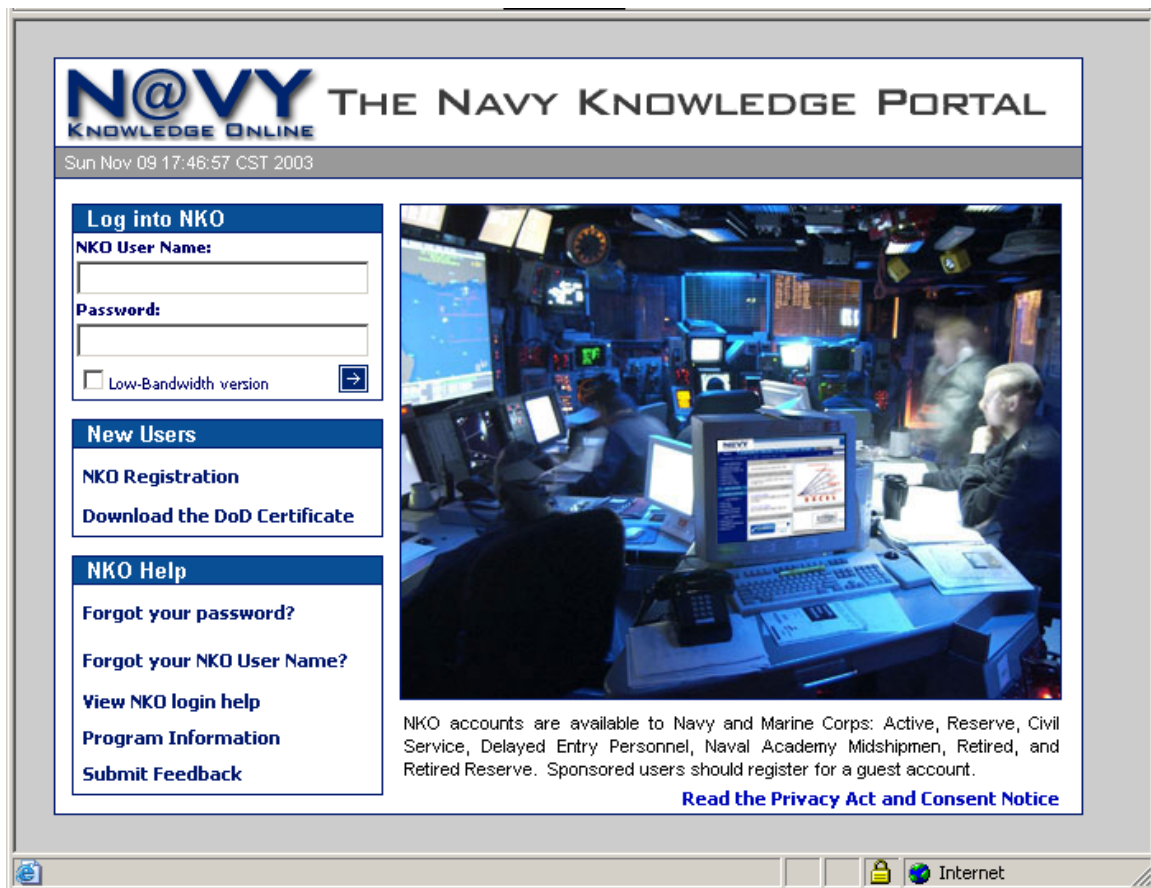


Figure 29. Navy Knowledge Online Portal access. Entrance to the world of the naval career.
(From [NKO])



Figure 30. Navy Knowledge Online home page. Stepping off point to anything a member needs for a naval career. (From [NKO])

The U.S. Navy has awarded Appian Corporation a multi-million dollar contract relating NKO. The contract includes additional scaling of NKO support and maintenance purchasing of additional hardware, beta-testing of an at-sea version of NKO; and the development of NKO SIPRNET (NKO-S), a classified version of NKO.

E. FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER (FNMOC)

FNMOC is leading the development of Web Services architecture for the METOC community to include a hosting environment and a Meteorology and Oceanography (METOC) Professional Portal. The METOC Enterprise Portal (MEP) is under the NEP umbrella, and explores leveraging of Open Source Software (OSS).

[Collab-03]

FNMOC defines Web Services as an opportunity for non-human actors to access structured data in XML using web protocols. Traditional web sites are not Web Services because they only output HTML. **[Collab-03]**

The Navy Enterprise Application Developer's Guide (NEADG) lists two basic categories of web services: **[Collab-03]**

- Data Oriented Service (DOS) - machine to machine access to data.
- User Facing Service (UFS) - for consumption by humans through a web browser.

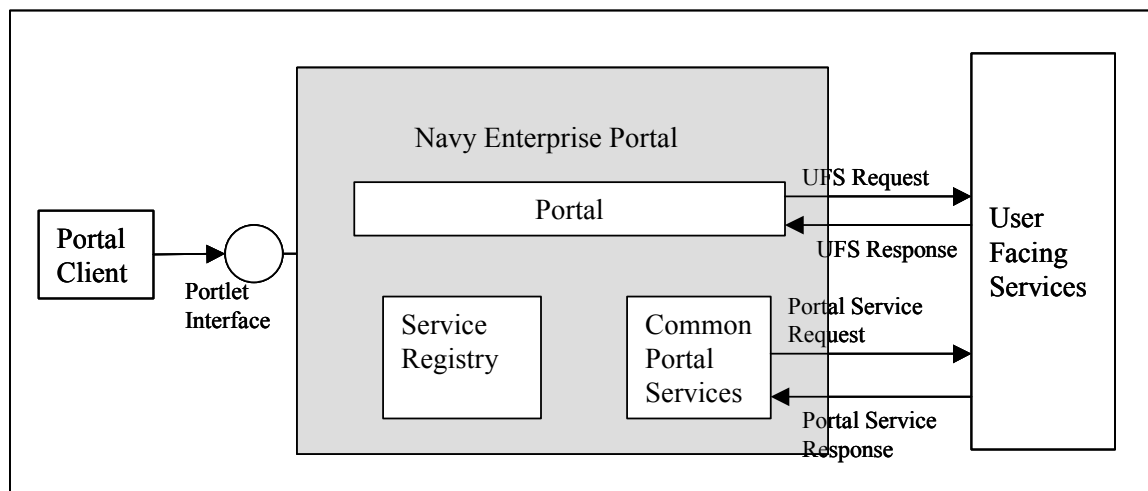


Figure 31. High level diagram of the N-tier Navy Enterprise Portal architecture (From: **[Collab-03]**)

The major pieces of of each instance in Figure 31 are: **[Collab-03]**

- Portal Client - the User Agent, such as a web browser, Personal Digital Assistant (PDA), telephone, etc.

- Portlet Interface - an agent which handles incoming user requests over HTTPS. It ensures the UFS requested is properly called.
- Portal, or "Portal Engine" - a framework for managing user preferences and allowing them to customize which portals appear on their page or pages.
- Service Registry - a UDDI registry, storing information about how to call UFSs on behalf of the Portal Client, and is accessed with a Service Key
- Common Portal Services – may be an XSLT transform engine, invoked either by the Portlet Interface, or even directly by a UFS

Ideally, all METOC products will be available as DOS. In other words, the output will be available in a Web Services format such as SOAP. For example, the Naval Search and Rescue (NSAR) model engine can be called, and return its output, in the form of a web service. The NSAR service would run on an application server as a DOS. The user interface provided to the NSAR module, in the form of a portlet, can run on the web tier, and call the NSAR service to perform its business logic, making the portlet a UFS.

[Collab-03]

FNMOE is using Java Servlets and Jakarta Struts frameworks to construct their UFSs. Struts is a framework for constructing Java-based web applications using a Model-View-Controller (MVC) paradigm. The ActionServlet is a controller provided by the framework. It is configured via an XML configuration file (struts-config.xml) to map incoming URL patterns to a particular ActionClass (the "Model") which the programmer writes for their application. Following the successful completion of the Action, the results are forwarded (usually via one or more Java "beans") to a presentation component, usually a JSP. Most Struts references tell the developer to put business logic in the Action class. In this architecture, the business logic should be in a separate web service. Therefore, the Action Class acts as a client, or consumer, of a DOS and the output from the JSP can be XML vice straight HTML. **[Collab-03]**

Future infrastructure services FNMOE is working on currently include: **[Collab-03]**

- Portal Request Interface (PRI) - XML data document will be passed to any UFS which runs in the portal. The contents of the PRI document are specified in Appendix E to the NEADG.
- Navy Enterprise Single Sign-on (NESSO) - will deal with the problem of user authentication.

- SAML – to provide more detailed security information about a particular user.
- The Java Caching Service (JCS) -a jar file to incorporate into the Java-based UFS applications. This allows caching a serializable Java object, getting back a unique key. This will reduce the total number of Web Services calls, improving overall performance.
- "Map Picker" – a component under development to allow a user to interactively select a geographic area from a map, vice entering points on a traditional HTML form.
- User Preferences Database (UPD) - a web service designed to prevent an application from having to worry about where to persist user customization data. An item such as an image or an XML file is sent via a SOAP call. The item can be retrieved later and used to provide the appropriate customization the next time the same user is seen.

The FNMOC Development Portal will be further examined in Chapter VI.

F. SUMMARY

The Navy is making significant strides in moving into the area of Web Portals. FNMOC and TF Web are working toward a common goal. To be effective, collaboration is important. NKO and the FNMOC portal are significant steps toward the goal of providing the Navy with easy to use and effective tools.

VI. CASE STUDIES

A. INTRODUCTION

Many Web sites are calling themselves portals. Most do not meet the criteria laid out in Chapter III. In this chapter, three sites are evaluated: FNMOC and the NPS Dudley Knox Library Portal for Homeland Defense, and NPS Undersea Warfare. Each site is evaluated on the following criteria introduced in Chapter III.

- Access and Security
 - Gateway – Does the system identify approved users through a single sign-on procedure?
 - Security – Are users are allowed access to information they can see, change information they can change and no more?
- Information
 - Customized information – Can the user to create the portal to suit their needs?
 - Channel information – Is information from internal and external sources provided?
 - Pushed information – Does the site owner select who receives which information?
- Functionality
 - Personalization – Can users edit the portal's look and some sources of information available on it?
 - Internet tools – Are search and navigation engines available? Can the user save favorite Websites, create home pages, and create/post message boards?
 - Personalized tools – Can users can create planners, calendars, to-do lists, web and home pages?
- Communications
 - Interaction – Are there interfaces for chat, e-mail, address books, threaded discussion, message boards and bulletin board postings?
 - Schedule meetings – Are calendars available?
 - Electronic balloting – Is there voting, survey functions, polling capability?

- Integration
 - o Workflow and application integration – Can users access data/applications needed to do their work in real-time environment?

B. FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER (FNMOC) PORTAL ASSESSMENT

Overall, the FNMOC portal (Figure 32 through Figure 43) is impressive. It meets most of the criteria for a portal as defined in Chapter III. The site is a highly specialized Vortal developed using Jetspeed for use in Meteorology and Oceanography. The administrators are working diligently, leading the efforts in Web Portal technology and use in the U.S. Navy.

1. Access and Security

a. Gateway.

Access to the site is accomplished through a sign-on page (Figure 32). Once logged in, no additional authentication is needed to access the other pages. FNMOC and TFW are currently collaborating to accomplish the NESSO, allowing a user to sign on to a site once and have that authentication follow him to other sites.

b. Security.

An account is requested from the administrator, who provides a user name and password. The user is able to change the assigned password, however the password change request form is on a separate URL from the main site. In April 2004, a DoD Public Key Infrastructure (PKI) Certificate will be required to access the site, improving the security posture.

2. Information

a. Customized information.

The user can customize each of the pages, and can create his own personal page (Figure 41).

b. Channel information.

FNMOC draws information from numerous sources, both internal and external. For example, BBC News and The Early Bird are available as portlets. (Figure 33 and Figure 42).

c. *Pushed information.*

There is a large volume of information that is pushed to the site, and the user is able to select the specific information desired.

3. *Functionality*

a. *Personalization.*

The user can edit the pages to a limited extent. The user can choose from among different layout designs (Figure 36) and color schemes. Within each page, the user can add or delete portlets to suit his preferences, and place the portlet at his desired location within the page (Figure 35).

b. *Internet tools.*

No Internet tools were found. Some Internet search tools that specialize in the area of METOC could be added for extra value to the site.

c. *Personalized tools.*

No personalized tools were found. This is a specialized information site, not intended to be a tool for collaboration.

4. *Communications*

As noted above, this is not a site intended for collaboration. Adding these features would not necessarily add any value.

a. *Interaction.*

No interfaces were found.

b. *Schedule meetings.*

No calendars were found.

c. *Electronic balloting.*

No electronic balloting functions were found.

5. *Integration*

a. *Workflow and application integration.*

This site is a highly specialized Vortal. It provides a large volume of data relating to Meteorology and Oceanography.



Figure 32. FNMOC portal sign-on (From [FNMOC])

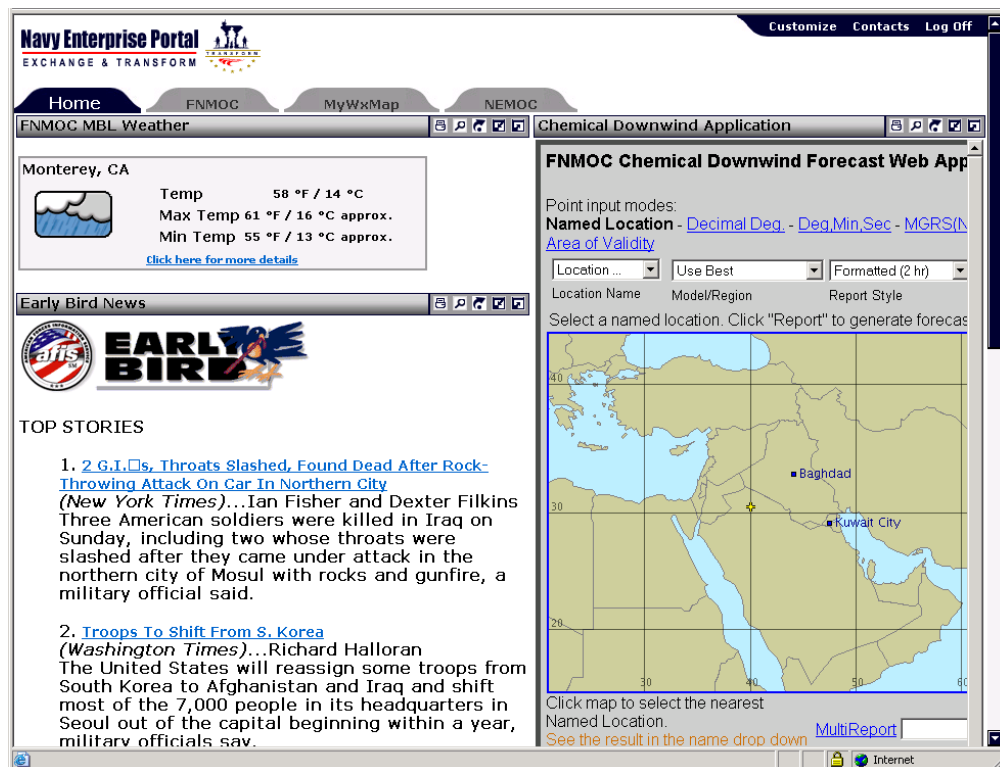


Figure 33. Default home page for FNMOC portal (From [FNMOC])

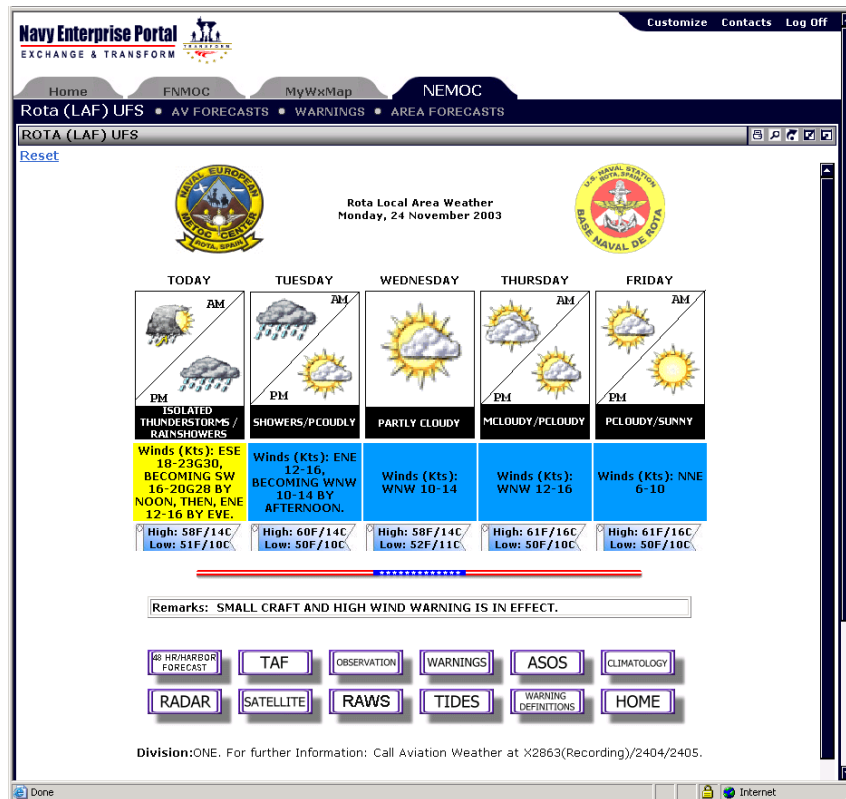


Figure 34. FNMOC portal tab, a page within the site (From [FNMOC])

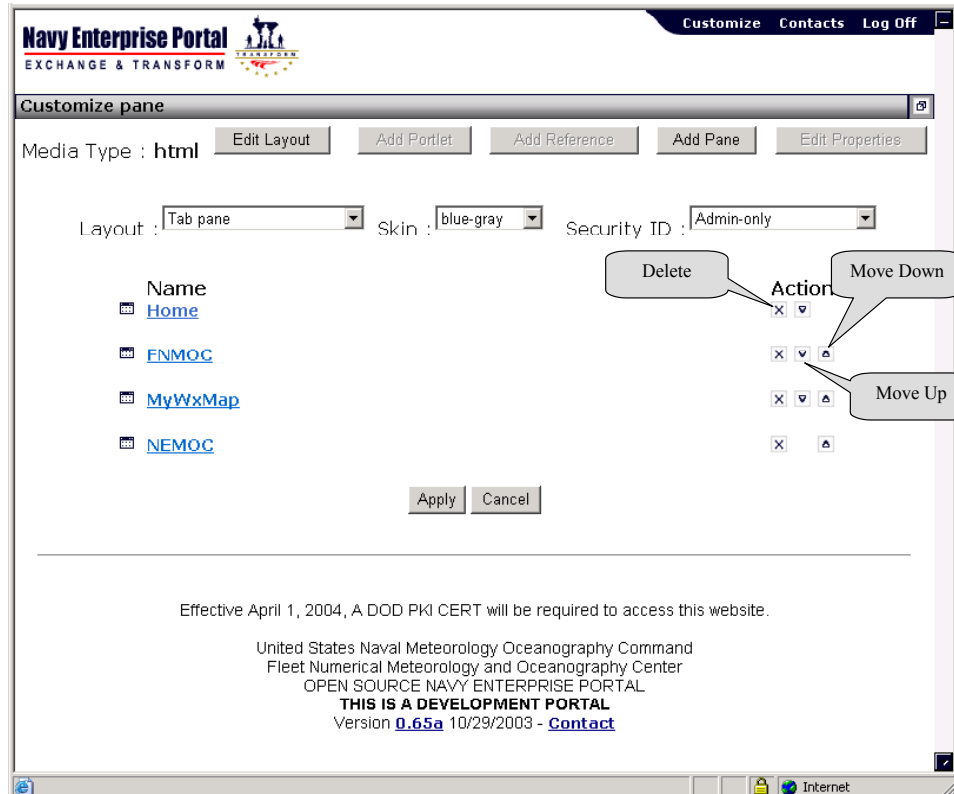


Figure 35. Customizing the FNMOC portal (From [FNMOC])

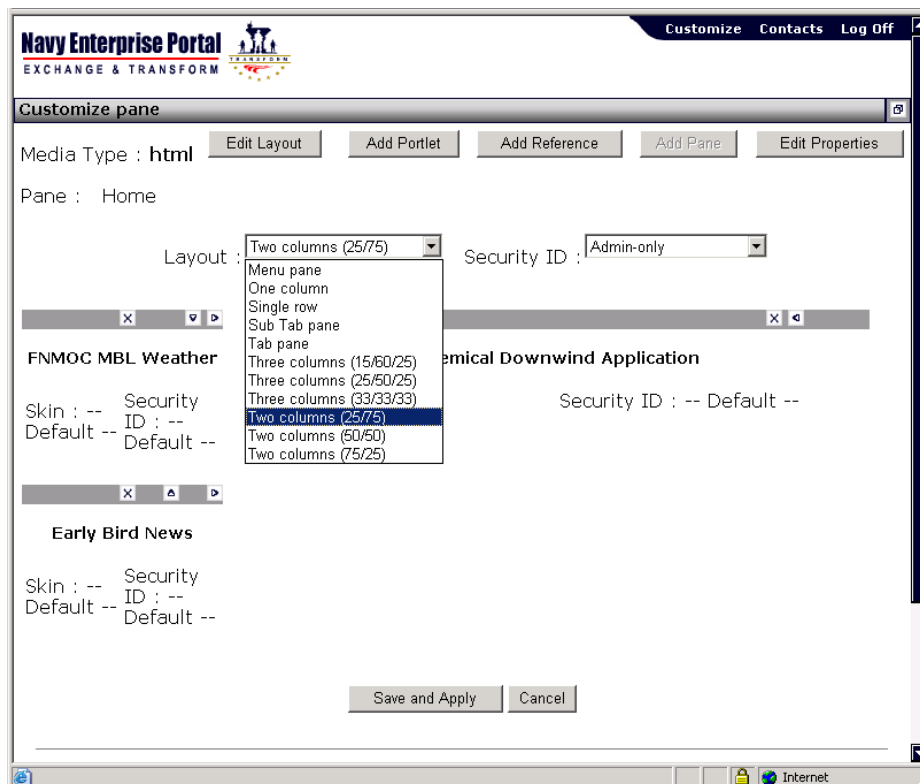


Figure 36. Customizing the FNMOC portal (From [FNMOC])

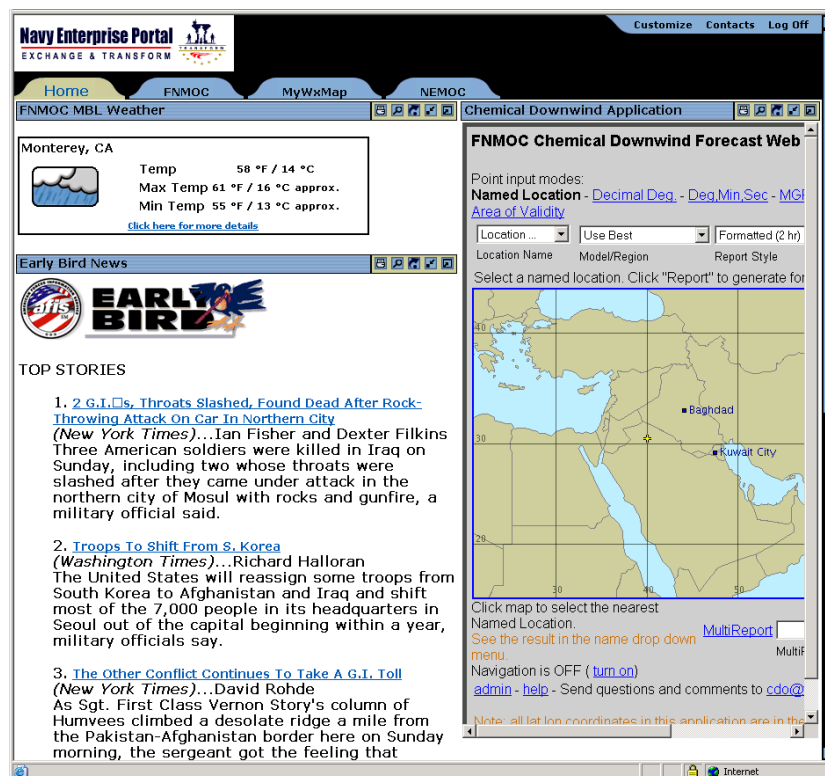


Figure 37. Color scheme change to the FNMOC portal (From [FNMOC])

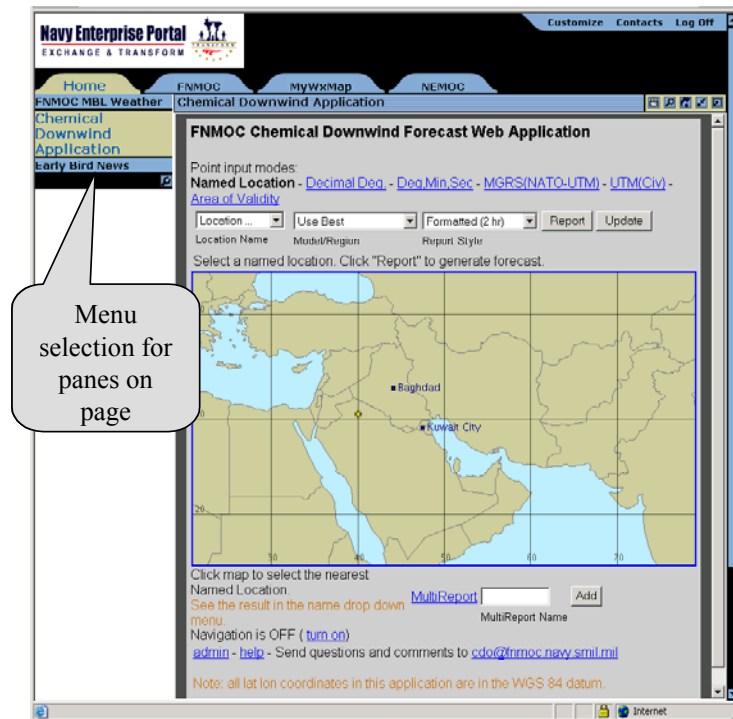


Figure 38. Change in pane selection style. Rather than having all the panes on one tab visible, a menu option is presented to view one pane at a time. (From [FNMOC])

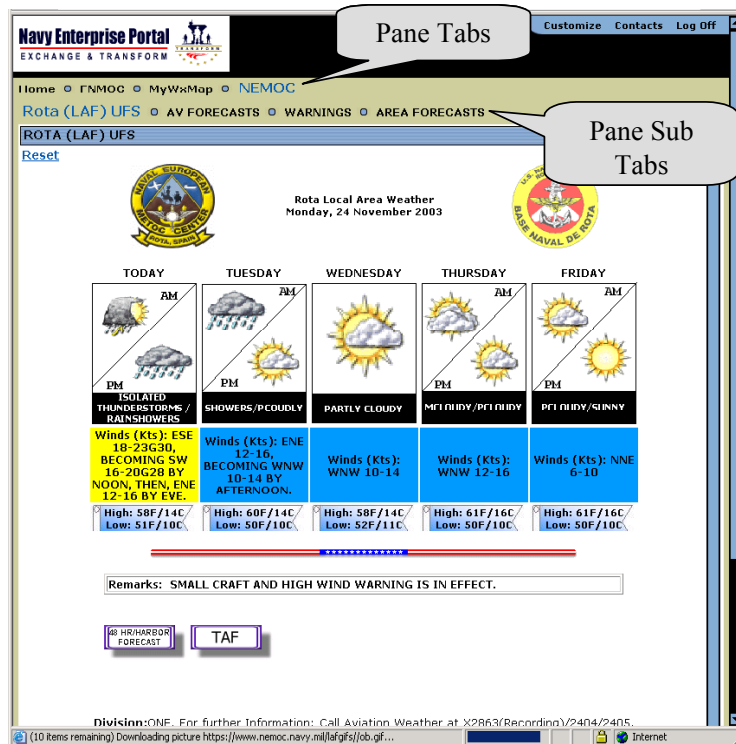


Figure 39. Another example of how the tabs and panes can be presented. (From [FNMOC])

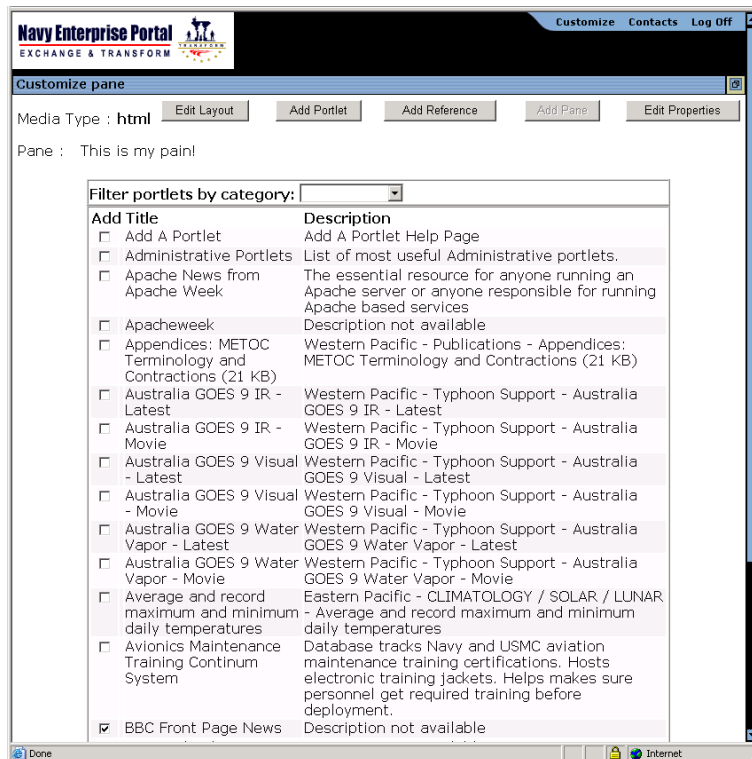


Figure 40. A partial list of information panes that can be added to a page. (From [FNMO])

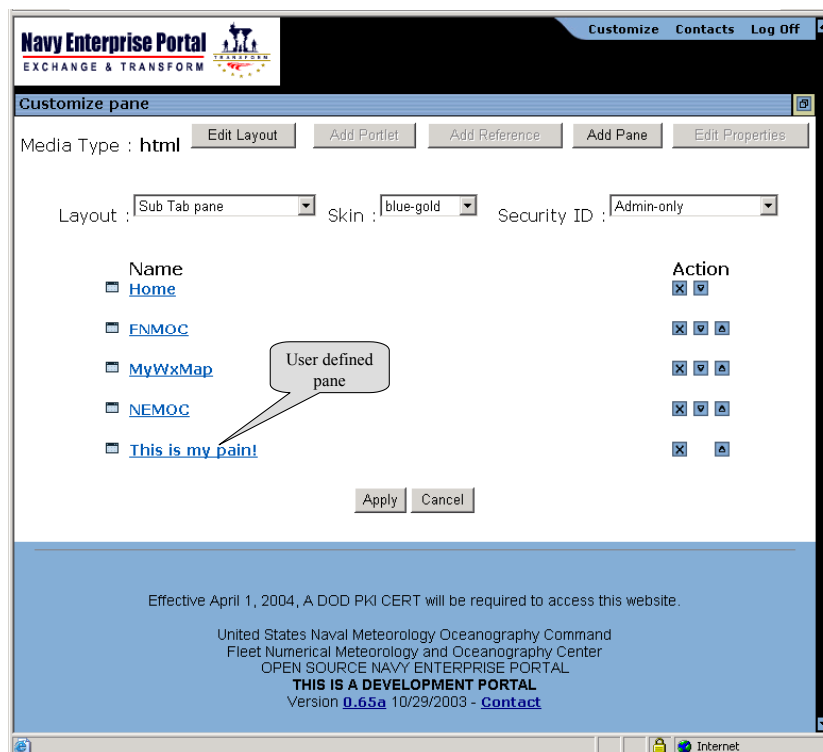


Figure 41. Users can create their own personal page. (From [FNMO])

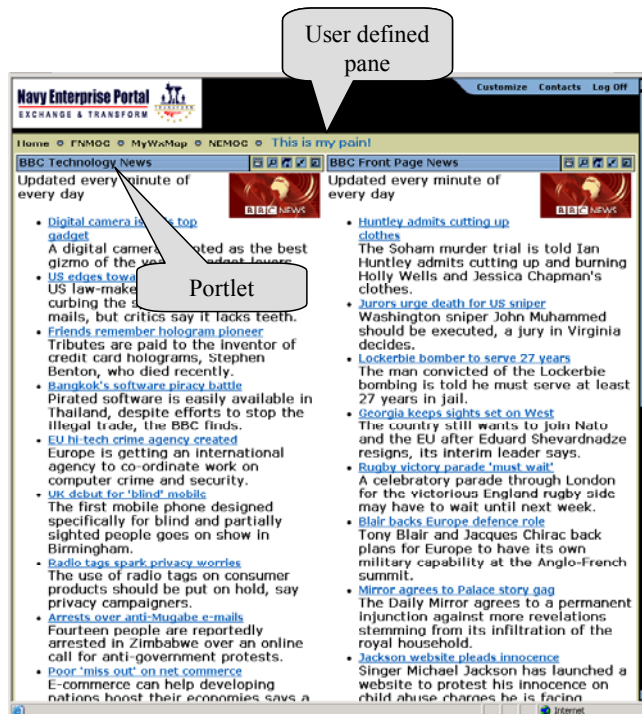


Figure 42. A user defined pane/tab containing two portlets in a two-column format. (From [FNMOG])

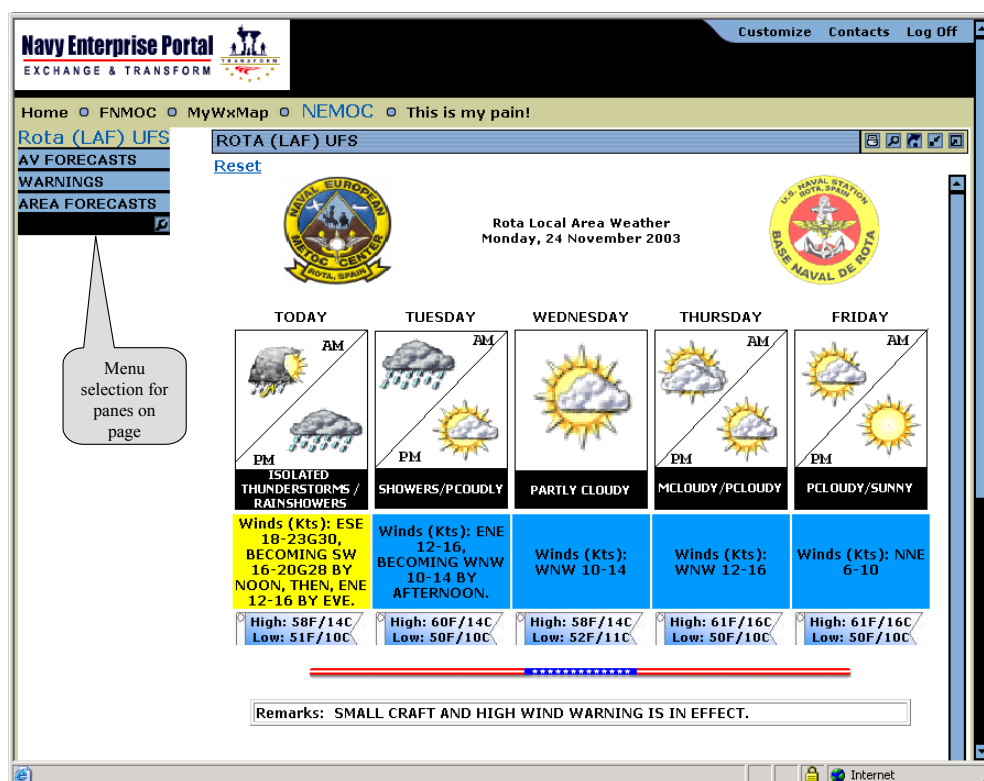


Figure 43. FNMOG Local Weather Channel (From [FNMOG])

C. DUDLEY KNOX LIBRARY PORTAL

The Dudley Knox Library site (Figure 44 through Figure 57) is designed using the Zope development tool. It provides a large volume of relevant and useful information, but is wholly controlled by the administrator. Because of the vast nature of the site, development of a portal to enable the user to narrow the focus would appear to be beneficial. The library site is not simply putting out a small volume of information for a focused audience. The site user would significantly benefit from the ability to focus the site to his needs.

1. Access and Security

Adding access and security features is necessary if the site is to be transformed into a portal. Users would probably find creating a personal account on the site to be useful in customizing the site to suit their specific needs.

a. Gateway.

No identification was required to access the site.

b. Security.

No access restrictions were found.

2. Information

Allowing the users to customize the site based on their interests would be useful. Currently everyone, students, faculty and staff, regardless of interest and focus, are presented with the same material. Creating a portal that allows users to create at least a personal page with relevant information found would significantly improve the experience. This personalized page would allow the user to save links and access points to the relevant information found, relieving them from repeating the searching process with each visit.

a. Customized information.

No customization capability was found.

b. Channel information.

Information from both internal and external sites is available.

c. Pushed information.

All information is pushed to anyone accessing the site. The site owner decides what information is provided to the users. The user can then select options to narrow or expand the information viewable.

3. Functionality

a. Personalization.

No personalization capability was found. While some users may enjoy the ability to customize the look of the site, it is not a feature that would add value.

b. Internet tools.

There are several tool options, and numerous tools within the options. The BOSUN search (Figure 45 through Figure 47) tool makes it easy to find a particular thesis based on a combination of criteria. Figure 56 collects various search engines, breaking them up into categories to assist the user in selecting the right tool for his needs.

c. Personalized tools.

No personalized tools were found. This feature does not fit the intent of the site.

4. Communications

Providing features in this functional area would not be of significant value. The purpose of the site is to provide a tool for the discovery of information and is not intended to be an interactive tool for the users to collaborate.

a. Interaction.

No interfaces were found.

b. Schedule meetings.

No calendars were found.

c. Electronic balloting.

No electronic balloting functions were found.

5. Integration

a. Workflow and application integration.

This site is attempting to be a specialized Vortal. It provides a large volume of data relating to the library and research. Users have access to a large array of information and tools. While it does not meet the criteria to be called a portal, it is a well designed tool that meets the needs of the intended users effectively. Turning this site into a true portal would probably not be the most effective use of resources and effort. Access

to the desired information is easy, following the guideline of having the most relevant information on the top of the first page at each point, with links to more expanded information located further down on the page or on another site.



Figure 44. Dudley Knox Library home page (From [DKL])

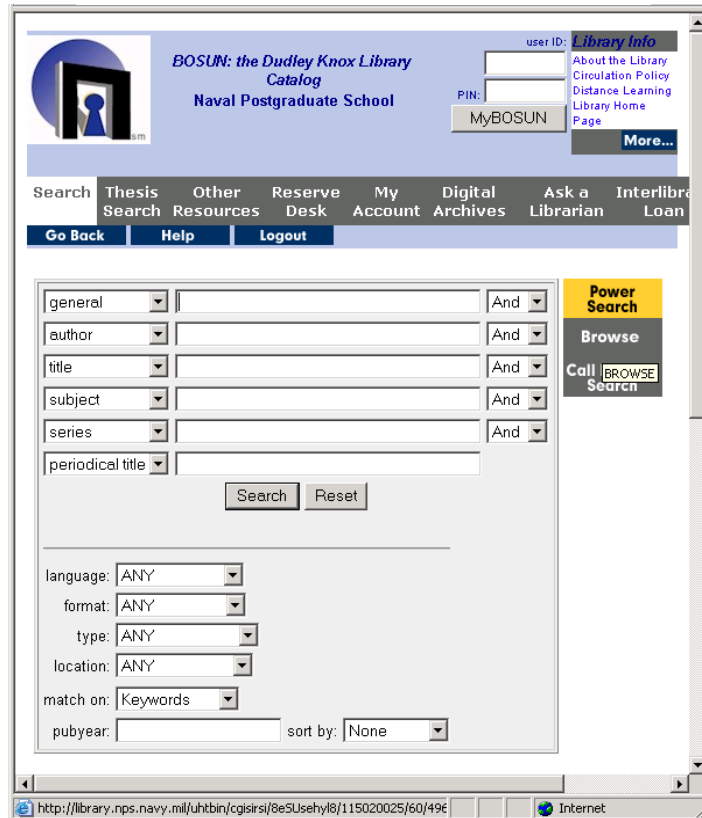


Figure 45. Dudley Knox Library BOSUN search tool (From [DKL])



Figure 46. Dudley Knox Library BOSUN Thesis search results on author last name “Hutton” (From [DKL])



Figure 47. Dudley Knox Library BOSUN thesis search result on CAPT Claude Hutton (From [DKL])



Figure 48. Dudley Knox Library Website search tool (From [DKL])

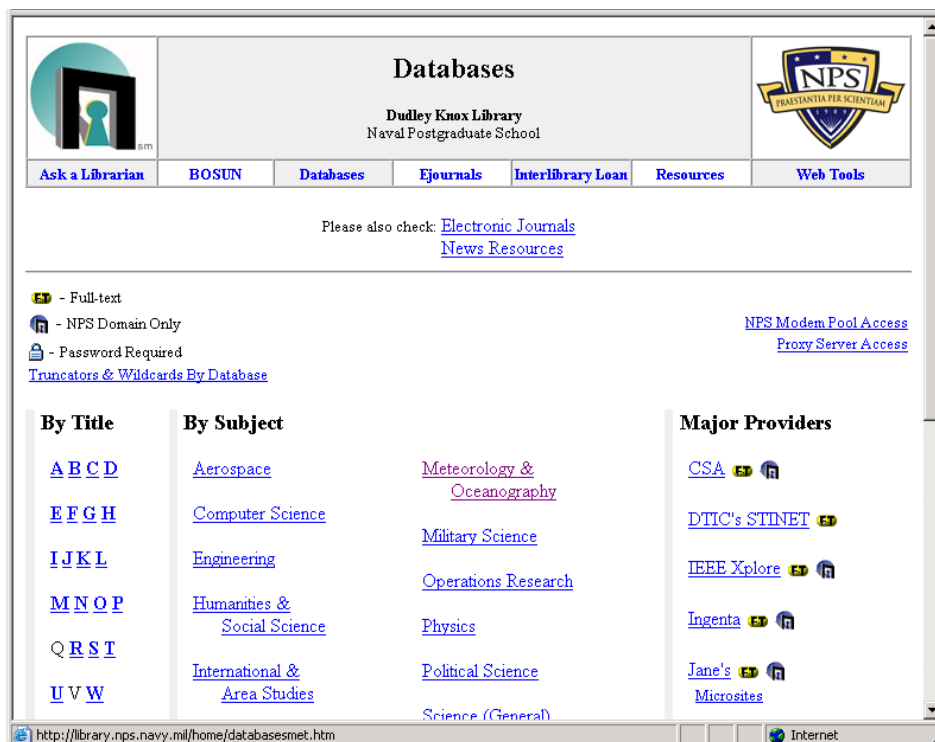


Figure 49. Dudley Knox Library Database search tool (From [DKL])



Figure 50. Dudley Knox Library database search tool, results of Meteorology and Oceanography (From [DKL])

Ask A Librarian

Dudley Knox Library
Naval Postgraduate School

[Ask a Librarian](#) [BOSUN](#) [Databases](#) [Ejournals](#) [Interlibrary Loan](#) [Resources](#) [Web Tools](#)

Our Electronic Reference Policy

Our e-mail reference service is provided primarily for Naval Postgraduate School faculty, staff and students with mission-related inquiries that are brief or factual in nature. Priority will be given to questions from nps.navy.mil e-mail addresses. In most cases we will respond to those questions within two working days (Federal Holidays excluded). We will respond to other requests as time permits, and will give priority to those from .mil and .gov e-mail addresses. For in-depth assistance, we may refer you to the appropriate [subject specialist](#) who may ask you to schedule an appointment or provide additional information.

Reference Question Information Form

Please use this form to submit your inquiry. It is not necessary to fill out every field. However, we can most effectively help you if you provide us with as many details as possible. Fields marked with an * must be filled out for your inquiry to be processed.

Information About You

- Name: *
- E-mail Address: *
- E-mail Address: * [Please enter a second time for verification]

You won't get an error message if the e-mail address is wrong, so please make sure it's correct.

- Status: *
- If you are an NPS student, faculty or staff member, what department are you in?:

<http://library.nps.navy.mil/home/databases.htm> Internet

Figure 51. Can't find it? Ask the librarian directly. (From [DKL])

Electronic Journals

Dudley Knox Library
Naval Postgraduate School

[Ask a Librarian](#) [BOSUN](#) [Databases](#) [Ejournals](#) [Interlibrary Loan](#) [Resources](#) [Web Tools](#)

Please also check: [Databases](#)
[News Resources](#)

By Title

[A B C D](#)
[E F G H](#)
[I J K L](#)
[M N O P](#)
[Q R S T](#)
[U V W](#)
[X Y Z](#)

By Subject

[Aerospace](#)
[Computer Science & Information Technology](#)
[Engineering](#)
[Health Science](#)
[Humanities & Social Science](#)
[International & Area Studies](#)
[Management & Economics](#)
[Mathematics](#)
[Meteorology & Oceanography](#)
[Military Science](#)
[Operations Research](#)

Major Providers

[ACM Digital Library](#)
[American Institute of Physics](#)
[ciao](#)
[Emerald](#)
[IEEE Xplore](#)
[Ingenta](#)
[Institute of Physics](#)
[JSTOR](#)
[Project MUSE](#)

<http://library.nps.navy.mil/home/ejournals.html> Internet

Figure 52. Dudley Knox Library Electronic Journals available through the library (From [DKL])

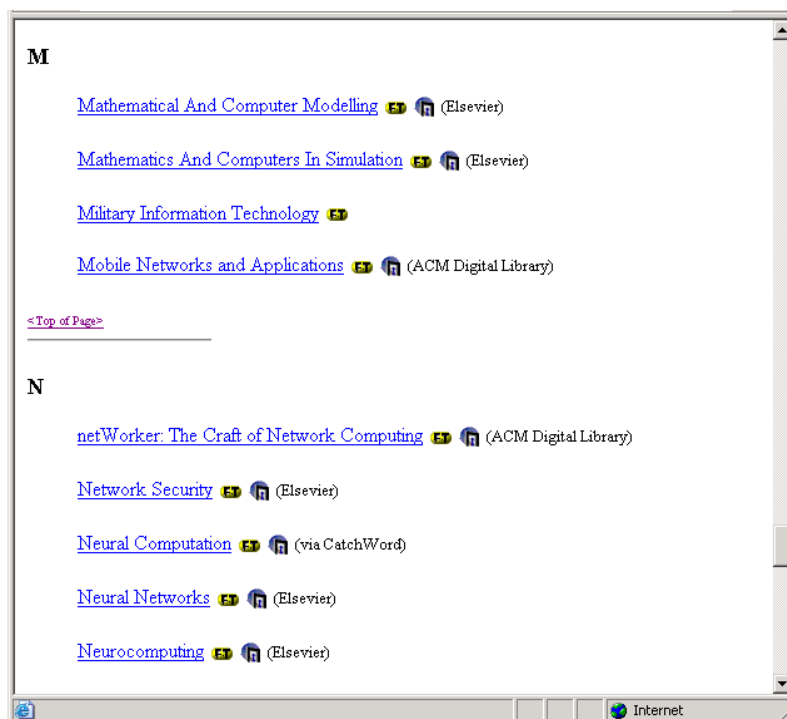


Figure 53. Dudley Knox Library Electronic Journals in Computer Science and Information Technology (From [DKL])

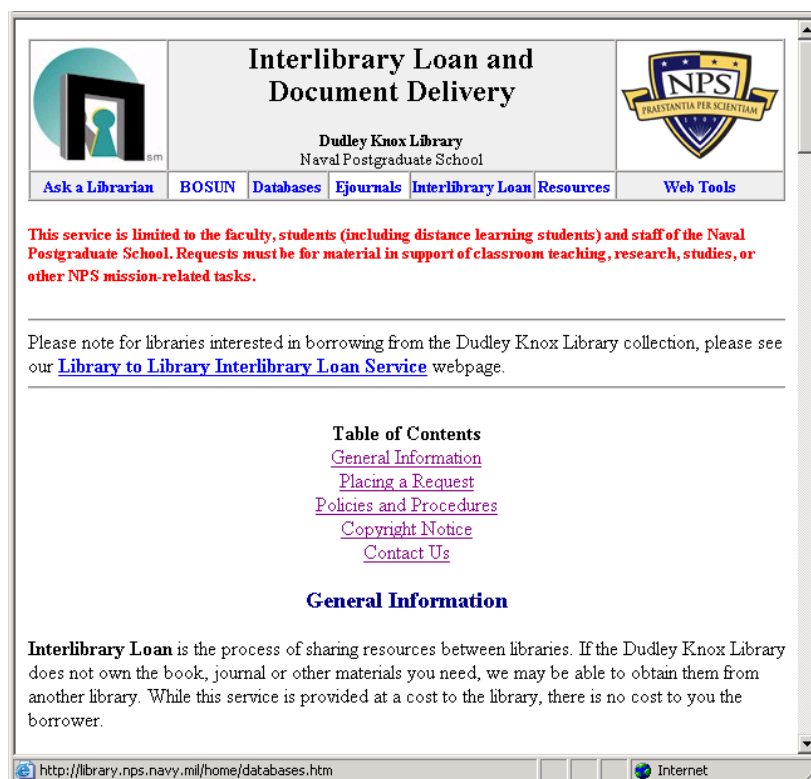


Figure 54. Dudley Knox Library's interlibrary loan request (From [DKL])



Figure 55. Dudley Knox Library resources available on-line (From [DKL])

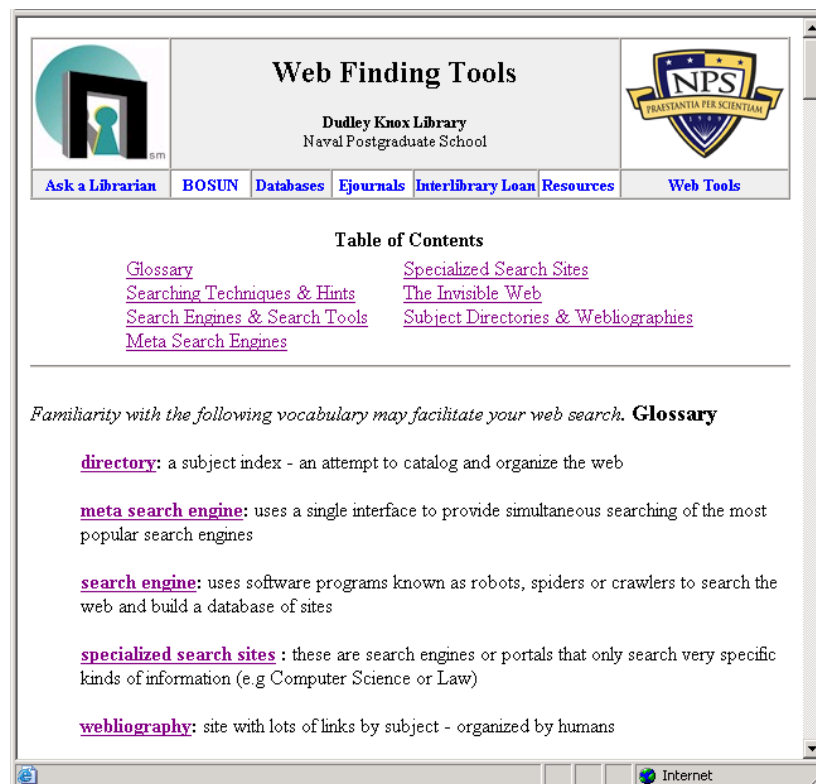


Figure 56. Dudley Knox Library Web and search tools available (From [DKL])



Figure 57. One of the categories of Web and search tools available through the Dudley Knox Library site. (From [DKL])

D. UNDERSEA WARFARE (USW) WEBSITE AND PORTAL DESIGN

The Undersea Warfare Curriculum is a masters degree offered at the Naval Postgraduate School (NPS) in Monterey. The focus is in the engineering fundamentals, physical principles and analytical concepts that govern operational employment of USW sensors and weapons. [USW]

The NPS USW site (Figure 58 through Figure 62) is not a portal, but a well-developed website whose designers aspire it to become a portal. Even though the information is provided by the administrators, with no user customization capabilities, users are able to provide information to the administrators for possible inclusion on the site through the contacts listed.

1. Access and Security

As this site is for the distribution of information, adding security features does not appear useful.

a. Gateway.

No gateway is detected.

b. Security.

Users can see all information, and can change nothing.

2. Information

The site is a reasonably small site with information relevant to a narrow scope of users. Navigating to the relevant information is easy from the home page. Allowing users to customize the site would not add significant value.

a. Customized information.

No portal capability is available.

b. Channel information.

External information is provided in the form of links to other sites of relevance (Figure 61 and Figure 62)

c. Pushed information.

The site owner decides what information is provided, and all users see all information.

3. Functionality

a. Personalization.

No capability is available.

b. Internet tools.

None were noted. Relevant links are already provided.

c. Personalized tools.

None were noted.

4. Communications

a. Interaction.

No real-time interaction is available. A listing of contacts is provided (Figure 60) to allow users to have some interaction and input.

b. Schedule meetings.

A calendar of events is provided (Figure 59). Users can submit their events to the administrator, but cannot directly add anything to the calendar of events.

c. *Electronic balloting.*

None is noted. No value would be added.

5. Integration

a. *Workflow and application integration.*

The access to information in a real-time environment is highly dependent on the administrators ensuring the data and links provided are current.

While the USW site may benefit from some of the capabilities of a portal design, careful evaluation of the needs of the users must be considered. It is unlikely the cost of effort expended compared to value added would be worthwhile. Overall, this site would not appear to be a candidate that would benefit from the development of a portal.

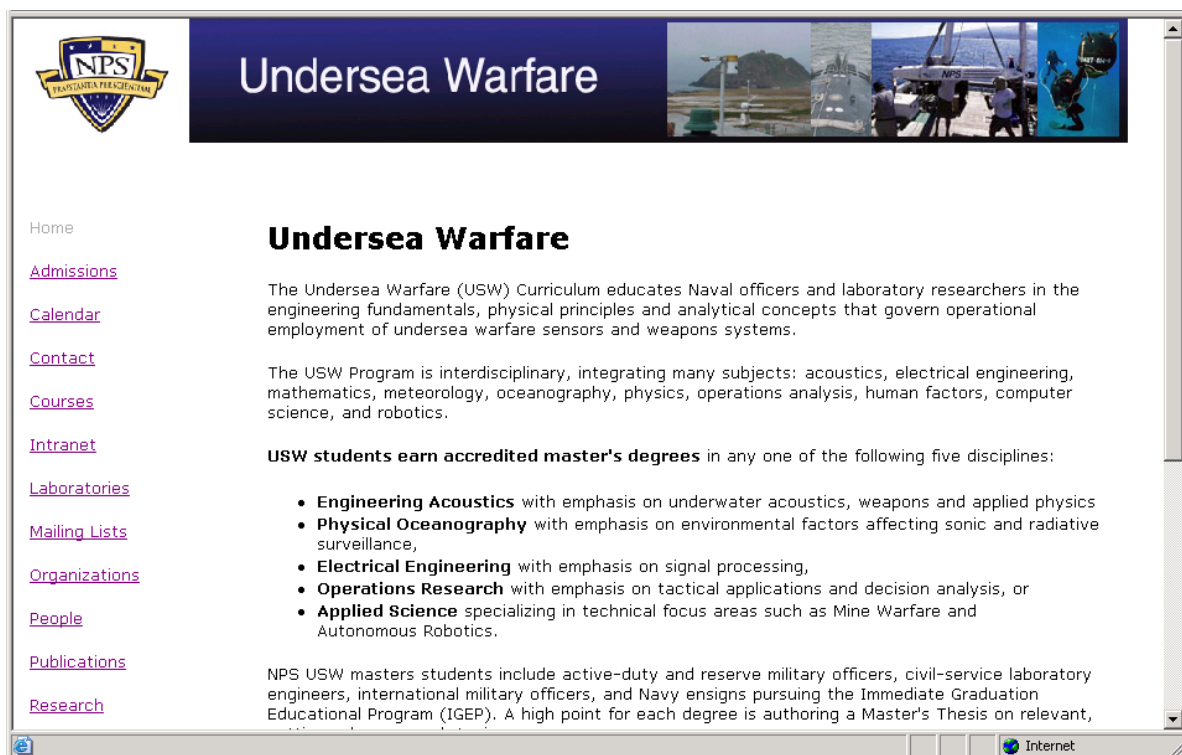


Figure 58. Undersea Warfare (USW) home page (From [USW])

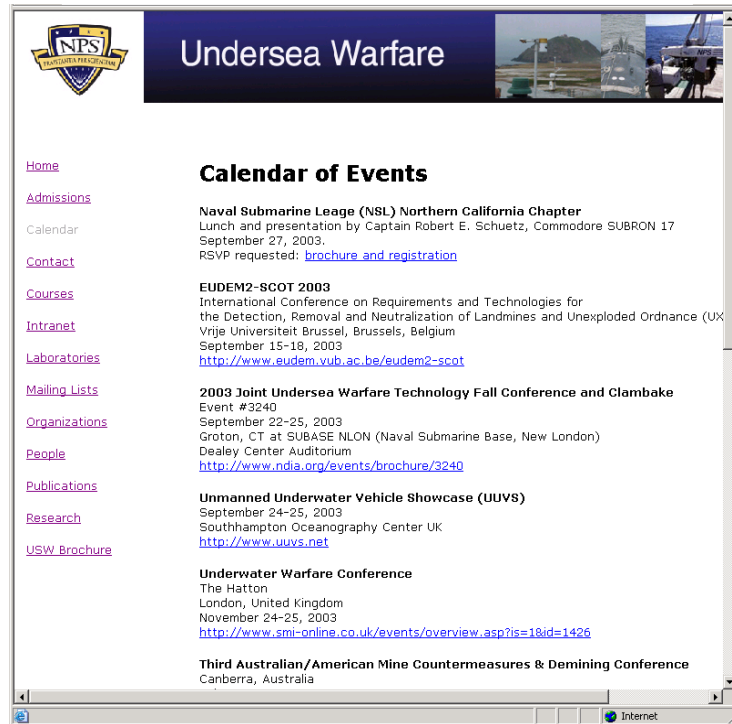


Figure 59. Listing of upcoming events of relevance to the USW community (From [USW])

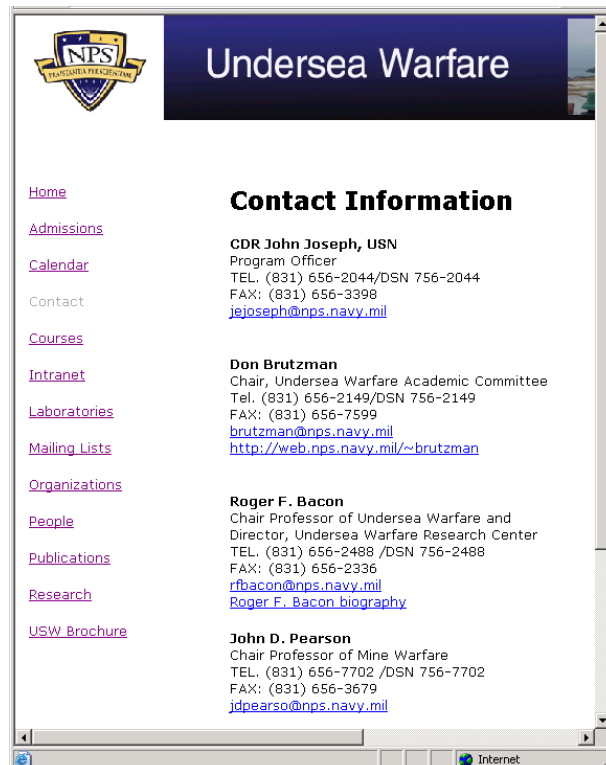


Figure 60. Contact information (From [USW])

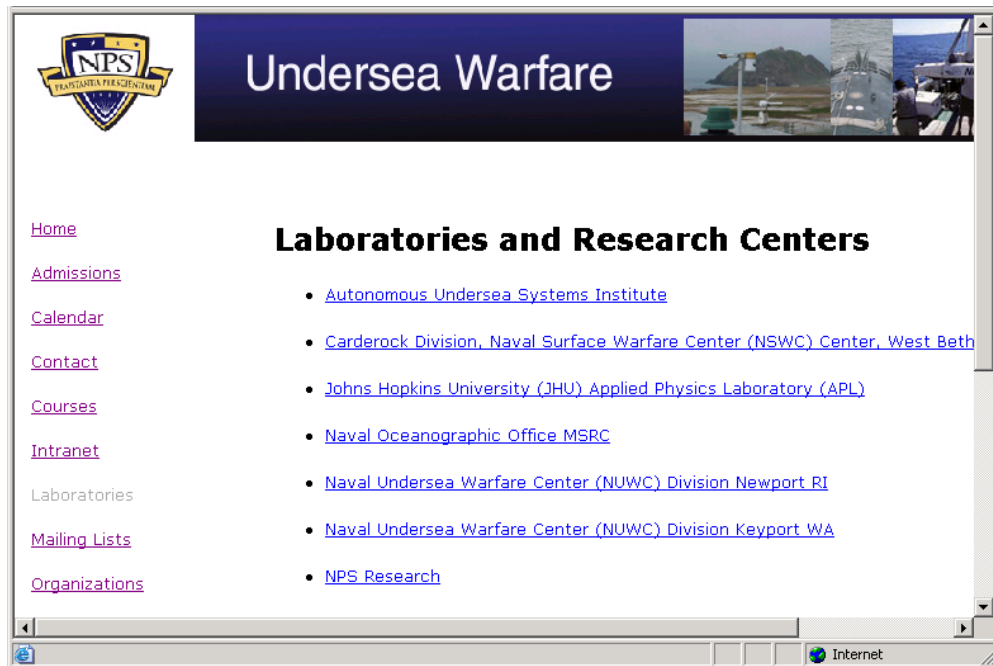


Figure 61. Links to sites relevant to USW (From [USW])



Figure 62. Links to organizations relevant to USW (From [USW])

E. SUMMARY

The three sites evaluated (USW, FNMOC and Dudley Knox Library) are vastly different in their targeted audiences, yet will have overlapping users. Table 2 provides an easy comparison of each site relevant to the criteria used in the evaluation. Each site is a representation of the diversity of Web design. The USW site is an example of a Web page. Simple in design, it provides useful information and links to the user. The Dudley Knox Library site is more extensive, providing tools for the users in a easy to find and use presentation. The FNMOC site incorporates many of the portal features, though it does not provide all the capabilities of a portal.

	Dudley Knox Library	FNMOC	USW
Access and Security			
Gateway	None	Access through a sign-on	None
Security	None	Administrator assigns user name and password, password can be changed by user	None
Information			
Customized information	None	User can customize each page and can create new personal pages	None
Channel information	None	Draws from internal and external sources and displays information in channels on the page	External information is provided in the form of links to other sites
Pushed information	Information is initially pushed allowing the user to select options to narrow or expand the information viewable	There is a large volume of pushed information to the site, but the user is able to decide which information is desired	Site owner decides what information is provided, all users see all information

	Dudley Knox Library	FNMOc	USW
Functionality			
Personalization	None	The user has limited page customization capability, layout and color schemes are predefined	None
Internet tools	Numerous tools available, categorized to assist in selecting the best tool	None	None
Personalized tools	None	None	None
Communications			
Interaction	None, users can contact staff via e-mail	None, users can contact administrators via e-mail	None, users can contact administrators via e-mail
Schedule meetings	None	None	None, a calendar of events is provided by administrator
Electronic balloting	None	None	None
Integration			
Workflow and application integration	An extensive and easy to use site that users can access to do their work	A specialized Vortal with limited access to other information as desired	Access to relevant information is dependent on the administrators ensuring the data and links provided are current

Table 2. Comparison of FNMOc, NPS Dudley Knox Library and USW sites

THIS PAGE INTENTIONALLY LEFT BLANK

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. Portal Development

Developing a portal requires careful consideration be given before implementation. Look carefully at the goals. Ask pertinent questions. Determine if a portal is really the best solution. Portions of a portal may be useful. A Web Service, or maybe even a simple Web page may be the best solution. As with any new technology, there is a tendency to jump in without weighing the costs and benefits. Ask questions.

- Is the end product truly a portal?
- Does the complexity of developing and maintaining a portal exceed the benefits derived?
- Could the information be better delivered as a simple page that can be pulled into a higher level portal site, such as NKO, as a portlet?

2. Portal Keys

If a portal is determined to be the most effective route, some key points to include when developing a portal:

- Plan, plan, plan before buying a design tool. Even a “free” tool has costs in time and effort.
- Understand who the users are and what they want.
- Include key people from the start, including users and developers.
- Look at what others have done to see what works well and what should be avoided.

3. Portal Wisdom

If a portal is the way to go, remember some simple portal wisdom:

- Keep it simple.
- Avoid “paralysis by analysis.”
- Any information system is 90% information and 10% system.
- Opt for effective service over cutting-edge technology. Not every new development is necessarily the best way to support the users.

- Don't discount new technology just because it is new
- Don't use new technology just because it is new.
- Avoid designs for the high-tech users. There aren't that many of them.
- "Yes" makes more friends than "No" – and it's easier to say.
- A great tool can create a masterpiece, and it can also make a mess.

B. RECOMMENDATIONS FOR FUTURE WORK

1. Single Sign-on (SSO)

With the plethora of sites requiring user authentication, the application of SSO may be the single biggest step toward simplifying and improving the users experience in using the Internet. Even within the Navy, the process of accessing sites becomes frustrating. Accessing the NKO, Bupers Online, and Thrift Savings Plan requires three different combinations of user identification and passwords.

Some of the user account names requirements include:

- Social security number (may require dashes, or not)
- Last four digits of the social security number
- Variations on using the name (how will duplicate names be resolved?):
 - o First initial and last name – initial may be before or after last name
 - o First, middle initial and last name
 - o Last name only
 - o First name, ".", last name
- Physical – this includes cards, fingerprints, etc.

Some of the password requirements include:

- System/administrator generated that cannot be changed – these are really hard to remember.
- System/administrator generated that can be changed by the user after initially logging in.
- Anything the user wants, from just a single keystroke to a novel.
- User generated variations with system restrictions:
 - o Maximum length
 - o Minimum length

- o Require any combination of the following: upper case, lower case, numbers, special characters
- o Disallowing use of special characters.
- Four digit pin – numbers only

With the advent of PKI, SSO looks possible. Within the DoD, the new military identification card in combination with a pin number should be sufficient to log into any site, such as NKO, and have that authentication follow the user as he travels through the Internet to other DoD and government sites seemingly invisible to the user. Just standardizing user identification and password rules would significantly simplify the process for the user, though it would require considerable efforts on the part of the system owners. This area is currently is being researched and developed jointly by TF Web and FNMOC.

As information and applications available on the Web continue to experience enormous growth, Web design will continue to be extremely challenging to make the right information readily available to users in the right form.

2. Navy Portal Development Strategies

Our end objective will be a single NMCP that will provide shared information to the entire department and other potential users, yet have sufficient flexibility to be customized by commands, functional communities and individual users. Hansford T. Johnson, Secretary of the Navy

a. Importance of Shared Strategies

As with any goal, a shared strategy is important across groups within an organization. David M. Wennergren, Department of the Navy, Chief Information Officer (DoN CIO), stated: **[Wennergren-03]**

Hand-in-hand with the rollout of the NMCI, we also want to move to an Enterprise Portal solution. Just as we talked about the large number of legacy applications, we also have a number of portals in the Department. While the scale is not as large, we do have a similar situation. Lots of innovative people trying to do good things have been building portals to gain access to information, share knowledge and perform transactions. That's great. But the problem becomes too many portals, too much duplication of effort, too much redundancy; and people have to make too

many choices about what data or knowledge they need rather than having a clear path to reliable knowledge and authoritative data sources.

Just as we had to whittle our way down through how many applications we had, we also have to whittle our way down through how many portals we have. I have been working with the Navy-Marine Corps team to implement the Secretary of the Navy's direction to move to the Navy Marine Corps Portal. This is an Enterprise Portal solution that will be a constituent portal strategy. It will not make every portal go away initially, but will instead, integrate what we need into a single portal structure where you will be able to find the intellectual capital of the Department whether you are deployed or ashore, at work or at home.

To be successful in this we need our commands to focus on content management. I don't need command X in New England to be the 500th command to build a portal and worry about a customized look and feel, and channel delivery and those sorts of things. What I need them to do is to think about what content their customers need to access, put that content onto an Enterprise Portal structure and let us have one organization worry about customized look and feel. PKI authentication will be on the front end of the portal with common services provided to everyone.

Mr. Wennergren's vision is significant. An overall common strategy is needed to control the growth of portal technology. It is important to limit the duplication of investment in portal technology in order to improve the efficient and effective deployment of portal technology. In a brief by CAPT Skip Hiser, the Navy/Marine Corps Portal (NMCP) vision should include: **[Hiser-03]**

- Limiting duplication of investment in portal technology to accelerate development efforts
- Reducing investment, promoting common best practices and facilitating authoritative databases
- Promoting DoN-wide process engineering
- Supporting functional and organizational collaboration across DoN

b. Separate Development Technology

In his memorandum, Navy Secretary Hansford T. Johnson laid out the principles for NMCP: **[Onley-03]**

- Ensuring the portal is capable of integrating and viewing data from shared sources using the service CIO's specified commercial standards for Web services
- Providing access to subordinate portals via the NMCP
- Providing SSO authorization using a PKI supported by the DoD's Common Access Card program
- Employing a modular, standards-based technical architecture with nonproprietary implementation
- Becoming the single portal for all navy and Marine Corps commands

Using non-proprietary products and open-standards will provide for a common environment. The goal should be to avoid product and vendor dependence. This direction will allow the switch-over to newer technologies easier. Relevant DoN offices, such as TF Web, should continue to work with the standards bodies.

When deciding on which tool to use in developing a portal, review several tools to determine which tool best supports the goal. Look at the technical skill sets available. A development tool like Jetspeed requires a significant technical skill level, but is a much more versatile than tools requiring less capability. In addition to the open source portal development tools reviewed in Chapter IV, there are numerous commercial products. As yet, no clear leader has surfaced. This is typical at this stage of technology development. Jetspeed, uPortal, and Plone are likely to remain strong contenders due to the wide use and interest of each.

Compatibility between portal development tools does not appear to be a concern, and should not become one. In developing this thesis, portals designed by Jetspeed, uPortal, Plone, and others were able to pull in data from internal and external sources. It can be compared to web browsers. There is a diversity of browsers available for use. While the majority of users have selected only a small subset of browsers to use, others are equally functional.

c. Roles and Responsibilities

A significant role is the support of functional and organizational collaboration in the development of portal technology throughout DoN. TF Web's mission is to provide integrated and transformational information exchange for both the

ashore and afloat navy to take full advantage of Navy's IT21 and NMCI infrastructure investments.

As the DoN moves forward, knowledge management is key to leveraging information technology investments. It is essential to identify leaders and champions and provide focused management attention in order to realize the potential of this critical movement. TF Web is just such a champion. In January 2001, when TF Web was established to take the portal from concept to implementation, there were around 100,000 applications. These were pared down to less than 8000 identified as being operational. The long-term goal is to reduce this number even further, somewhere around 700.

[Jackson-03] Having TF Web in a position to oversee the growth in a comprehensive and controlled environment has significantly improved the overall effectiveness of the project. The goal is to enable the Navy to take advantage of NMCI, eliminating redundancy and compatibility problems that result when there is no clear oversight.

[McKenna-03] Their continued efforts will be crucial to the future development of Navy Web portals.

Monica Shephard, Director of C4 and Combat Systems U.S. Navy Atlantic Fleet, pointed out: "We may have disagreements now about whether a particular effort takes advantage of Web services in the best way possible, but we're not arguing about whether Web services is pertinent to the U.S. Navy." TF Web is well suited and positioned to continue this effort into the future.

APPENDIX A. LIST OF ABBREVIATIONS

ACM	Association for Computing Machinery
ADL	Advanced Distributed Learning
AOL	America Online
ASF	Apache Software Foundation
API	Application Programming Interface
B2B	Business to Business
BEEP	Blocks Extensible Exchange Protocol
CAC	Common Access Card
CGI	Common Gateway Interface
CIO	Chief Information Officer
CSS	Cascading Style Sheet
DHTML	Dynamic Hypertext Markup Language
DKL	Dudley Knox Library
DoD	Department of Defense
DoN	Department of the Navy
DOM	Document Object Model
DOS	Data Oriented Service
DTD	Document Type Definition
EIP	Enterprise Information Portal
ERNT	Executive Review of Naval Training
EXCEL	Task Force for Excellence through Commitment to Education and Learning
FAQ	Frequently Asked Questions
FNMOC	Fleet Numerical Meteorology and Oceanography Center
GIF	Graphic Interchange Format
HLA	High Level Architecture
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Secure HTTP
IEEE	Institute of Electrical and Electronics Engineers
J2EE	Java 2 Enterprise Edition
JA-SIG	Java in Administration Special Interest Group
JCS	Java Caching Service
JDK	Java Development Kit
JSP	Java Server Pages
KM	Knowledge Management
LAN	Local Area Network
LES	Leave and Earnings Statement
LMS	Learning Management System
M&S	Modeling and Simulation
MEP	METOC Enterprise Portal
METOC	Meteorological and Oceanography
MVC	Model-View-Controller

NAVADMIN	Navy Administrative
NCTAMS	Naval Computer and Telecommunications Area Master Station
NESSO	Navy Enterprise Single Sign-on
NEP	Navy Enterprise Portal
NETC	Naval Education and Training Command
NEADG	Navy Enterprise Application Developer's Guide
NKO	Navy Knowledge Online
NKO-S	NKO SIPRNET
NMCI	Navy/Marine Corps Intranet
NMCP	Navy/Marine Corps Portal
NPDC	Naval Personnel Development Command
NPS	Naval Postgraduate School
NSAR	Naval Search and Rescue
OSD	Office of the Secretary of Defense
OSS	Open Source Software
PDA	Personal Digital Assistant
PDF	Portable Document Format
PKI	Public Key Infrastructure
PNG	Portable Network Graphics
PPW	Personal Portable Webpage
PSML	Portal Structure Markup Language
PRI	Portal Request Interface
RDF	Resource Description Framework
RPC	Remote Procedure Call
RSS	RDF Site Summary
RTI	Run Time Infrastructure
SAML	Security Assertions Markup Language
SCO	Sharable Content Object
SCORM	Sharable Content Object Reference Model
SIGGRAPH	Special Interest Group on Graphical Display
SGML	Standard Generalized Markup Language
SMTP	Simple Mail Transfer Protocol
SOAP	Simple Object Access Protocol
SSO	Single Sign-on
TIFF	Tagged Image File Format
TF Web	Task Force Web
UDDI	Universal Description, Discovery and Integration
UFS	User Facing Service
UPD	User Preferences Database
URL	Uniform Resource Locator
USW	Undersea Warfare
W3C	World Wide Web Consortium
WAI	Web Accessibility Initiative
WAP	Wireless Application Protocol
WSDL	Web Services Description Language
XHTML	Extensible Hypertext Markup Language

XSL	Extensible Stylesheet Language
XSLT	Extensible Stylesheet Language Transformations
XML	Extensible Markup Language
XMSF	Extensible Modeling and Simulation Framework
ZOPE	Z Object Publishing Environment
ZPT	Zope Template Pages

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

- [**ACM Montreal**] ACM SIGGRAPH Montreal Retrieved From: <http://montreal.siggraph.org/fr/index.html> (Nov03)
- [**ADL**] Advanced Distributed Learnin, Retrieved From: <http://www.adlnet.org> (Nov03)
- [**ADL-03**] Academic ADL Co-Laboratory, LearnWise, Retrieved From: http://aadlc-srvr3-p.aadlcolab.org/common_sql/pim.asp (Nov03)
- [**AJP**] Apache Jakarta Project, Jetspeed, Retrieved From: <http://jakarta.apache.org/jetspeed/site/index.html> (Nov03)
- [**Anderson-03**] Anderson, Sharon, Building a Web Centric Navy, Transforming Business and Operations With Web Technology, Chips, Winter 2002, Retrieved from: http://www.chips.navy.mil/archives/02_winter/index2_files/building_a_web_centric_navy_tran.htm (Nov03)
- [**ASU**] Arizona State University, Retrieved from: <http://myasuportal.asu.edu/uPortal/render.userLayoutRootNode.uP> (Nov03)
- [**Barrett-03**] Barrett, Danielle, Navy Enterprise Services, Chips Magazine, Summer 2003, Retrieved from: <http://www2.clf.navy.mil/tfw/tfw.nsf/html/ahtml?opendocument> (Nov03)
- [**Bb**] Blackboard, Retrieved From: <http://www.blackboard.com> (Nov03)
- [**BC**] BabyCenter, Retrieved From: <http://www.babycenter.com> (Nov03)
- [**Bieter-03**] Bieter, Kurt, Kosuke Ishii, Integrating Producibility and Product Performance Tools Within a Web-Service Environment, Stanford University, Sept 2003, Retrieved from: <http://mml.stanford.edu/Research/Papers/2003/ASME/CIE2003-48281.pdf> (Nov03)
- [**Biggs-01**] Biggs, Maggie, XML Defined, Federal Computer Week, 15 Oct 2001, Retrieved from: <http://www.fcw.com/fcw/articles/2001/1015/tec-xmlbar1-10-15-01.asp> (Nov03)
- [**Bobby-03**] Bobby™, Retrieved From: <http://bobby.watchfire.com/bobby/html/en/index.jsp> (Nov03)
- [**Cerami-02**] Cerami, Ethan, Web Services Essentials, 2002
- [**Collab-03**] Open Source Navy Enterprise Portal Exchange and Transformation Collaboration Site, Retrieved from <https://collab.metnet.navy.mil/cgi-bin/collab/login/portal> (Nov03)

- [COSE] COSE, Stafford University, Retrieved From:
<http://www.staffs.ac.uk/COSE/cosenew/SCORM.doc> (Nov03)
- [DKL] Dudley Knox Library, Retrieved from: <http://library.nps.navy.mil/home/> (Nov03)
- [DKL-02] Status of the DKL Web Redesign Project, Retrieved from:
<http://it003306.ad.nps.navy.mil:8080/DKL/General/Web/Docs/Misc> (Nov03)
- [Dodds-03] Dodds, Philip, Retrieved from:
<http://www.adlnet.org/index.cfm?fuseaction=scormabt> (Nov03)
- [Dynamicdrive] Dynamic Drive, Retrieved from: <http://www.dynamicdrive.com>
(Nov03)
- [ebiz-03] U.S. Navy Upgrades KM Portal to Appian Enterprise, ebiz, October 2002,
Retrieved from: <http://www.ebizq.net/news/2958.html> (Dec03)
- [Eisler-03] Eisler, David L, Portal Features, Weber State University, Retrieved From:
<http://faculty.weber.edu/deisler/handouts.htm> (Nov03)
- [Falkman] Falkman, Drew, Enterprise Portals at non-Enterprise Prices, 4 Apr
2003 Retrieved from:
http://www.intranetjournal.com/articles/200304/pij_04_04_03a.html (Nov03)
- [FNMOC] FNMOC Enterprise Portal, Retrieved from:
<https://www1.metnet.navy.mil/osnepn/> (Nov03)
- [Gaines-95] Gaines, Brian and Mildred Shaw, Implementing the Learning Web,
University of Calgary, Retrieved From:
<http://www.repgrid.com/reports/LW/EM96Tools/EM96Tools.pdf> (Nov03)
- [Gersappa-02] Gersappa, Sanat, Zope as a Content Management Tool, 2002, Retrieved
from: http://www.web-enable.com/technology/zope_tool.asp (Nov03)
- [Giguere] Giguere, Eric, The Mobile Developer, wireless Developer Network, Retrieved
from: <http://www.wirelessdevnet.com/columns/apr2000/mobdev08.html> (Nov03)
- [Gleason-01] Gleason, Bernard W., uPortal: A Common Reference Framework, July
2001, Retrieved From: <http://www.sun.com/products-n-solutions/edu/whitepapers/uportal.html> (Nov03)
- [GNU-03] GNU's Not Unix, Retrieved from: <http://www.list.org> (Nov03)
- [Hiser-03] Hiser, Skip, Navy Portal Development, 17 June 2003, Retrieved from:
http://proceedings.ndia.org/3690/Tuesday_Breakout_RoomC/TFWebHiser1.pdf (Dec03)
- [Hypermail-03] What is Hypermail? Retrieved from:
<http://www.hypermail.org/source/docs/hypermail.html> (Nov03)

[**IBM-03**] IBM Mobile E-business Solutions, WebSphere Integration in a Nutshell, June 2002, Retrieved from: http://www.x-fetch.com/Component_WhitePapers_PDF/SolutionWP_WPS_AS2_ver2.pdf (Nov03)

[**Infravio-03.1**] Web Services: Next Generation Application Architecture, Cupertino, CA: Infravio, July 2003, Retrieved From: <http://www.infravio.com/whitepaper/> (Nov03)

[**Infravio-03.2**] Web Services: The Executives Guide, Cupertino, CA: Infravio, July 2003, Retrieved From: <http://www.infravio.com/whitepaper/> (Nov03)

[**Intranets**] What is a Portal, Retrieved From: http://www.intranets.com/ProductInfo/FAQs/What_Is_A_Portal.asp?l=n (Nov03)

[**JA-SIG**] JA-SIG (Java Architectures Special Interest Group) uportal, Retrieved From: <http://mis105.mis.udel.edu/ja-sig/uportal/> (Nov03)

[**Jackson-03**] Jackson, William, Navy Portal Aims to Host 3000 Apps, Government Computer News, 26 May 2003, Retrieved from: <http://www2.clf.navy.mil/tfw/tfw.nsf/html/ahtml?opendocument> (Dec03)

[**Lists-00**] Retrieved From: <http://www.lists.ic.ac.uk/hypermail/xml-dev/xml-dev-Feb-2000/index.html> (Nov03)

[**Looney-03**] Looney, Michael, Web Portals in Higher Education, 13 Sep 2003 Retrieved From: http://www.ferris.edu/library/publications/techtips/no_11/portals.html (Nov03)

[**Matsumura-98**] Matsumura, Miko, XML Speeds Along in Standards Land, Java World, February 1998, Retrieved from: <http://www.javaworld.com/javaworld/jw-02-1998/jw-02-miko.html> (Nov03)

[**McKenna-03**] McKenna, Ed, Military Big on Portals, Federal Computer Weekly, 9 June 2003, Retrieved from: <http://www2.clf.navy.mil/tfw/tfw.nsf/html/ahtml?opendocument> (Dec03)

[**Morse-03**] Morse, Katherine L., XMSF, Retrieved from: http://www.scs-europe.org/conf/ess2003/keynote_morse.html (Dec03)

[**NESSO**] Navy Enterprise Single Sign-On, Retrieved from: <https://www.metnet.navy.mil/~hutchina/nesso/> (Nov03)

[**Newcomer-02**] Newcomer, Eric, *Understanding Web Services*, Indianapolis, IN, Pearson Education, Inc., 2002

[**Nielsen-96**] Nielsen, Jakob, PhD, Top Ten Mistakes in Web Design, May 1996, Retrieved From: <http://www.useit.com/alertbox/9605.html> (Nov03)

[**Nielsen-99**] Nielsen, Jacob, Ten Good Deeds in Web Design, Oct 1999, Retrieved From: <http://www.useit.com/alertbox/991003.html> (Nov03)

[**NKO**] Navy Knowledge Online, Retrieved from: <https://wwwa.nko.navy.mil/> (Nov03)

[**Novotny**] Novotny, Jason, Michael Russell, Oliver Weherens, A Portal Framework For Building Collaborations, June 2003, Retrieved from:
http://virtual01.lncc.br/mgc2003/cam_ready/MGC281_final.pdf (Nov03)

[**Novotny-03**] GridSphere: A Portal For Building Collaborations
<http://virtual01.lncc.br/mgc2003/transp/MGC@Middleware2003-281.pdf> (Nov03)

[**Onley-03**] Onley, Dawn S., Navy Sets Up XML For Portal, Government Computer News, 7 April 2003, Retrieved from: http://www.gcn.com/22_7/manager/21591-1.html (Dec03)

[**Parks-02**] Parks, Kenneth and Bruce Carson, Enterprise Portals in Higher Education, Edgewater Technologies, Inc. 2002, Retrieved From:
http://www.edgewater.com/site/solutions/resume_topics/Higher_Ed/enterpriseportals.pdf (Nov03)

[**Plone**] plone, Retrieved From: <http://plone.org/> (Nov03)

[**PNG-03**] Portable Networks Graphics, Retrieved from: <http://www.libpng.org/pub/png/> (Nov03)

[**Rapoza-03**] Rapoza, Jim, Plone Opens Up Web Publishing, 7 April 2003, Retrieved from: <http://www.eweek.com/article2/0,3959,1007949,00.asp> (Nov03)

[**SCORM-02**] SCORM: A sharable and interoperable model for e-learning May 7, 2002 Retrieved From: <http://builder.com.com/5100-6387-1045417.html> (Nov03)

[**SCWP**] Semantic Community Web Portals, 9th International World Web Conference, Retrieved From: <http://www9.org/w9cdrom/134/134.html> (Nov03)

[**Siggraph-03**] Retrieved From: <http://www.siggraph.org> (Nov03)

[**SolAdv**] Solutions Advantage, Retrieved from:
<http://www.solutionsadvantage.com/dhtmldemo.asp> (Nov03)

[**Strauss-00**] Strauss, H., What is a portal, anyway?, Retrieved From:
<http://www.syllabus.com/techtalks/events/000120portal.asp> thru
<http://www.syllabus.com/techtalks/archive.asp> (Nov03)

[**Sullivan-02**] Sullivan, Andrew, The Blogging Revolution, Wired Magazine, Issue 10.05, May 2002, Retrieved From:
<http://www.wired.com/wired/archive/10.05/mustread.html?pg=2> (Nov03)

[**Swallow-03**] Swallow, Tina, Danielle Barret, Transforming the Navy with Web Technology, Chips Magazine, Spring 2003, Retrieved from:
<http://www2.clf.navy.mil/tfw/tfw.nsf/html/ahtml?opendocument> (Nov03)

[TFW-03] Task Force Web Home Page, Retrieved from:
<http://www2.clf.navy.mil/tfw/tfw.nsf/html/ahtml?opendocument> (Nov03)

[Tran] Tran, Luu, Authoring Device Independent Portal Content, Sun Microsystems, Inc., Retrieved From: <http://www.w3.org/2002/07/DIAT/posn/sun-portal.html> (Nov03)

[Traversa-00] Traversa, Eddie, Intro to DHTML, 13 September 2000, Retrieved from:
<http://www.dhtmlshock.com/printarticle.asp?ArticleID=1> (Nov03)

[Uportal] uPortal, Retrieved From: <http://mis105.mis.udel.edu/ja-sig/uportal/download.html> (Nov03)

[USW] Undersea Warfare homepage, Retrieved from: <http://www.nps.navy.mil/usw/> (Nov03)

[W3C] World Wide Web Consortium, Retrieved From: <http://www.w3.org/> (Nov03)

[W3C-g] W3C, Web Services Glossary Working Draft Aug 2003, Retrieved From:
<http://www.w3.org/TR/ws-gloss/#intro> (Nov03)

[WAI] Web Accessibility Initiative, Retrieved From: <http://www.w3.org/WAI> (Nov03)

[WAI-02] Web Accessibility Initiative, Retrieved From: <http://www.w3.org/Talks/WAI-Intro/slide1-0.html> (Nov03)

[Wennergren-03] Wennergren, David M., Interview with the DoN CIO, Chips, Fall 2003, Retrieved from:
http://www.chips.navy.mil/archives/03_fall/web_pages/wennergren.htm (Dec03)

[Wired-03] Wired News Magazine, Retrieved From: <http://wired.com> (Oct03)

[XMSF-03] XMSF Brochure, Moves Institute, Naval Postgraduate School, Monterey, CA, Retrieved From: <http://www.movesinstitute.org/xmsf/XmsfBrochure.pdf> (Nov03)

[XSLT-03] XSLT Basics, Retrieved from:
http://dl.lib.brown.edu/staff/yott/nelinet/XSLT_basics.doc (Nov03)

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

Defense Technical Information Center
Ft. Belvoir, Virginia

Dudley Knox Library
Naval Postgraduate School
Monterey, California

Don Brutzman
Naval Postgraduate School
Monterey, California

Curt Blais
Naval Postgraduate School
Monterey, California

Barb Helfer
Naval Postgraduate School
Monterey, California

CAPT Chris Gunderson, USN
Fleet Numerical Meteorology and Oceanography Center
Monterey, California

CDR Chris Vance
Naval Postgraduate School
Monterey, CA

RADM Andy Singer
Naval Network Warfare Command
Norfolk, Virginia

Monica R. Shephard
Chief of Naval Operations (N09W)
Washington, DC

Dan Boger
Naval Postgraduate School
Monterey, California

Saundra Amsden
Naval Postgraduate School
Monterey, California